



MYSTERIES
OF

NATURE

& ART

BATE

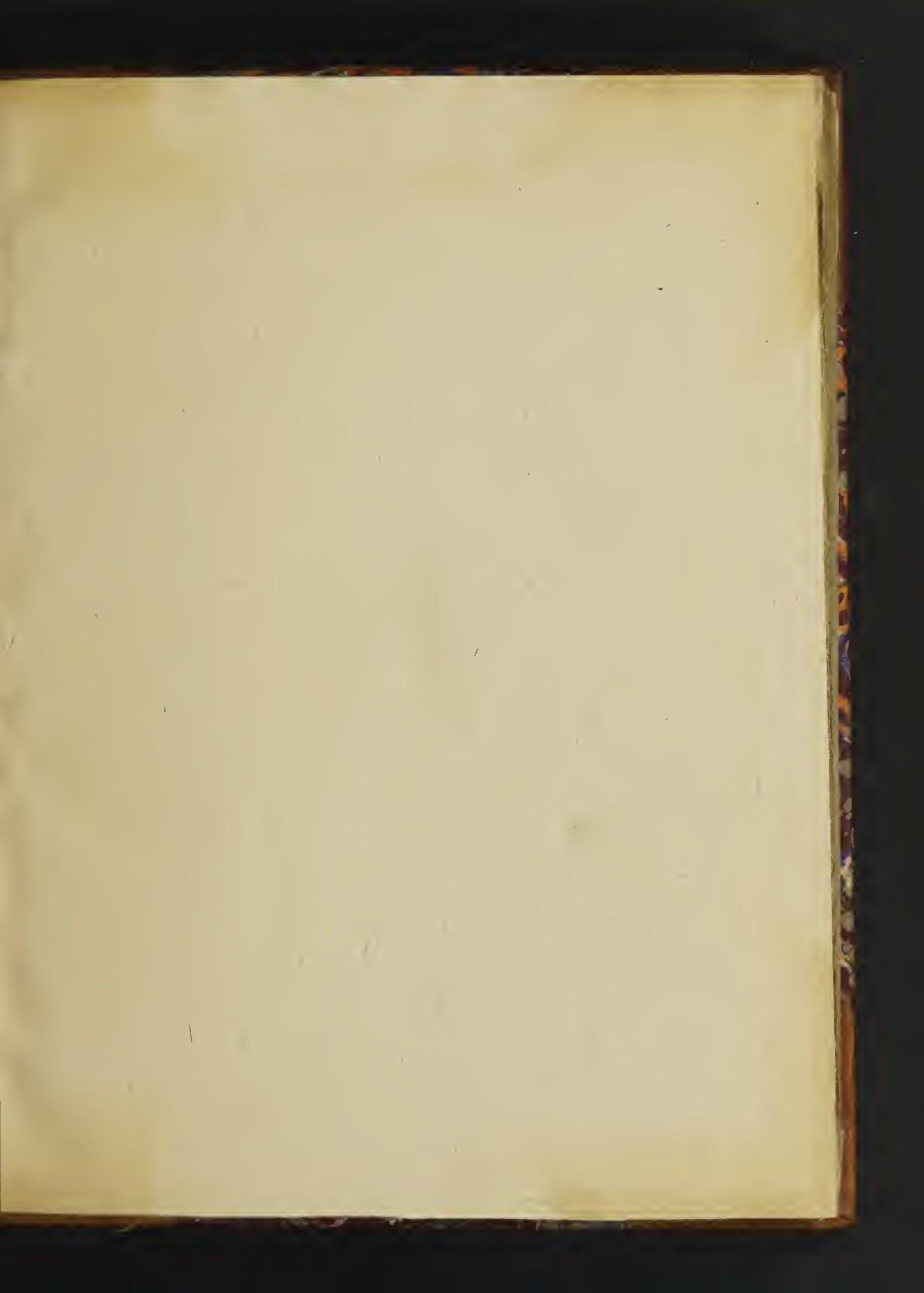
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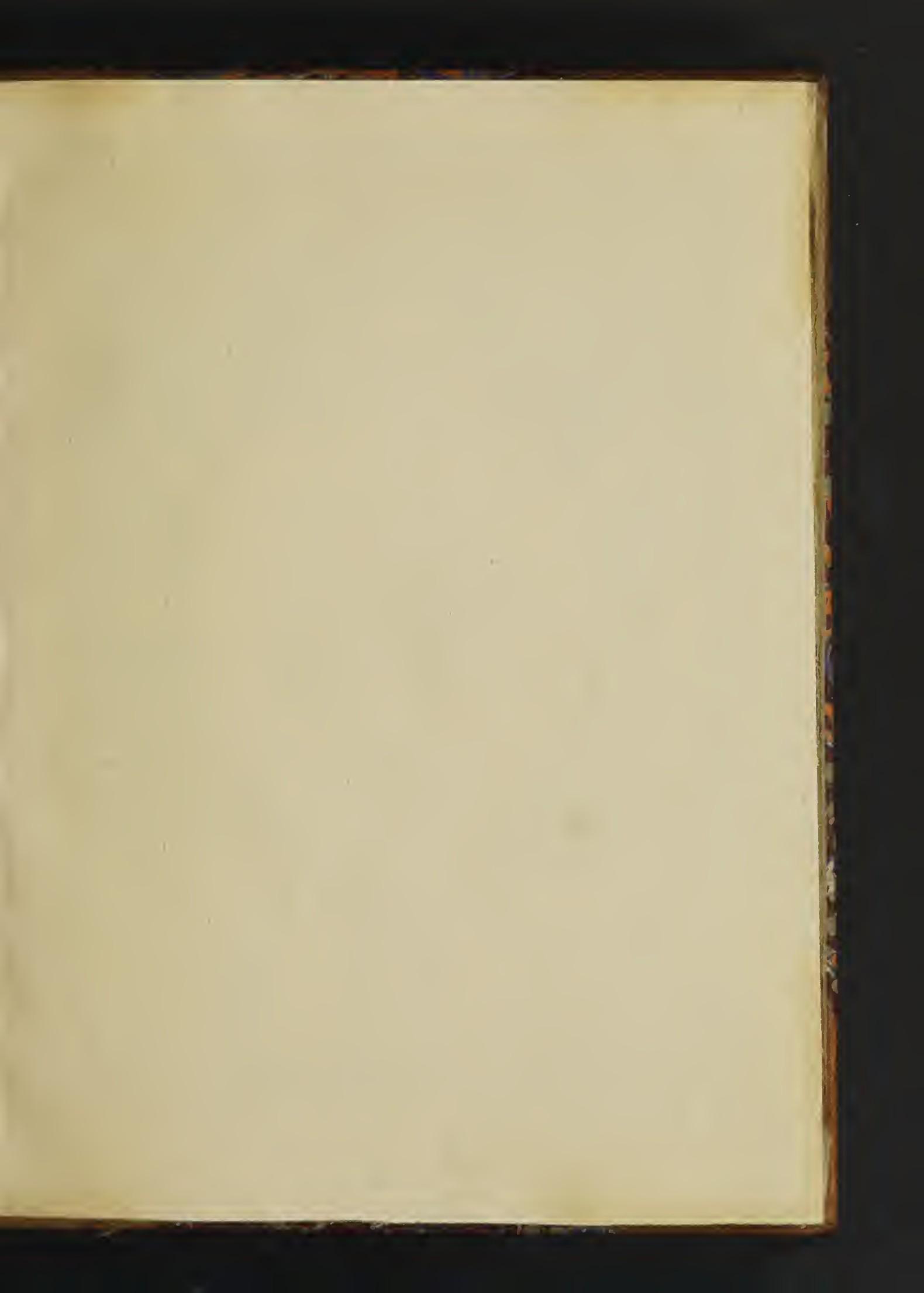


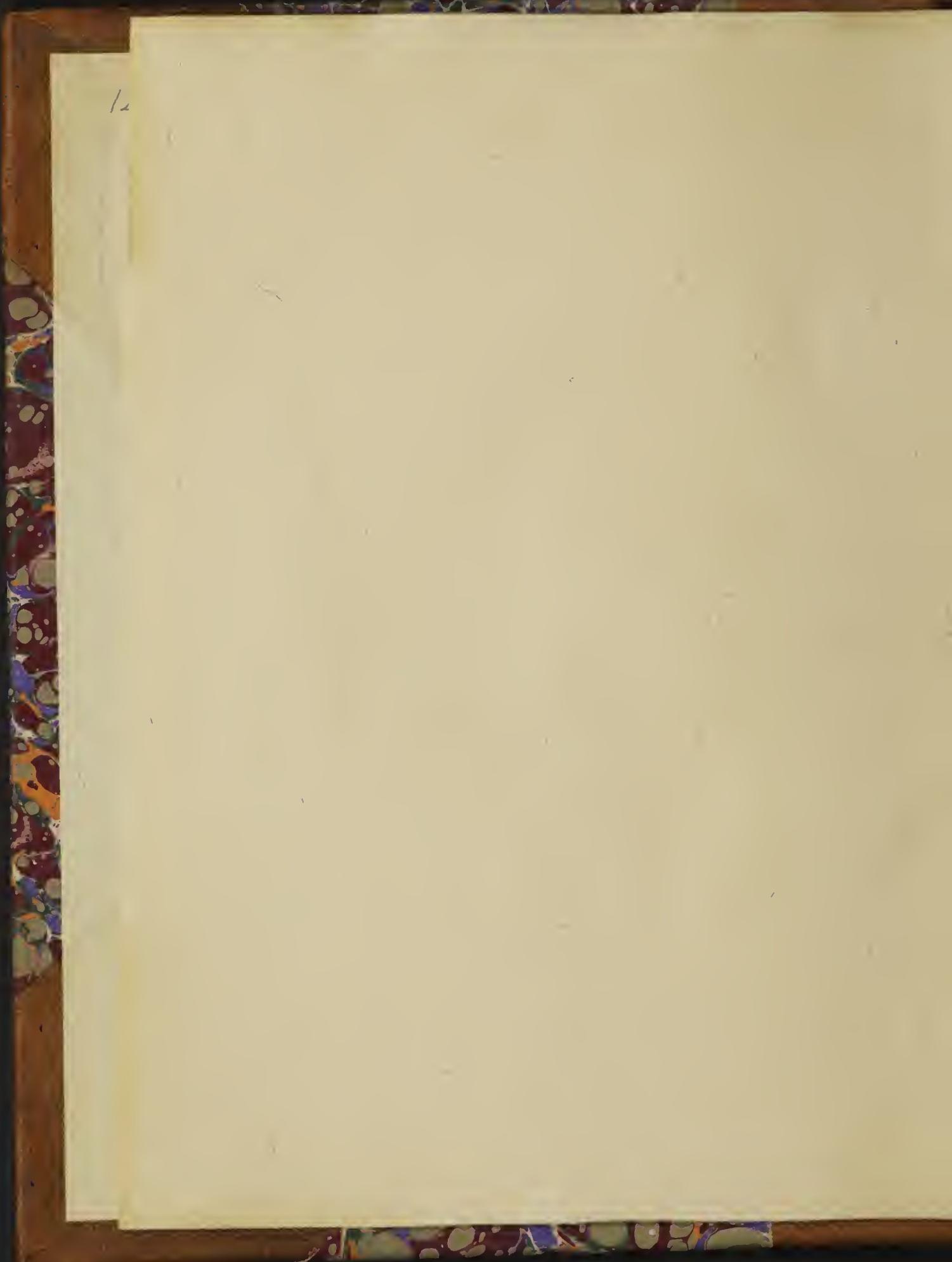


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THE
MYSTERIES
OF
NATURE and ART.

In four severall Parts.
The first, of Water-Works.
The second, of Fier-Works.
The third, of Drawing, Colouring, Limming, Paynting, Engraving, and Etching.
The fourth, of sundry Experiments.

By JOHN BATE.

The third Edition

With many Addi-
tions

Printed for Andrew Crooke 1654



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L O N D O N .

Printed by R: Bishop for Andrew Crook, at the Green:
Dragon in Pauls Churchyard. 1654.

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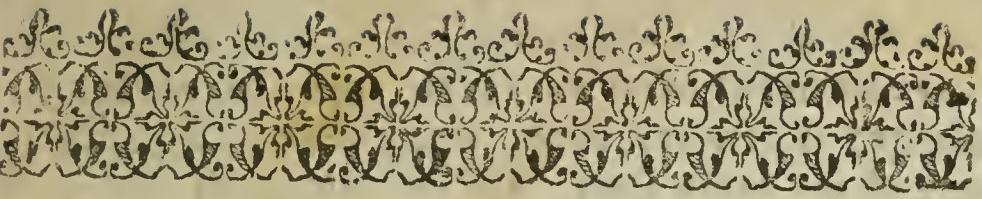
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To the Reader.

Courteous Reader,



His ensuing Treatise hath layn by me a long time penned, but in a confus'd and undigested manner, as either my Practise, Reading, or Conference suggested the Experiments. It was not in my minde to have exposed it so soon to publique censure, but the importunity of many and my friends, have wrested it from my hands, and made it common. Expect no elegancy of phrase, for I endeavoured as much as I could to write in playn Tearms, that it might suit with the meanest capacity. The Subjects admit no curious Method, neither could my Ocasions afford me time to bethink my selfe of any whereunto I might mould it, nor indeed to be my own Transcriber.

The whole Book consisteth of Foure Parts : the first whereof treateth of Water-works, the second of Fire-works, the third of Drawing, Washing, Limming, Payntng, and Engraving ; the fourth and last of sundry Experiments both serviceable and delightfull, which because they are confusedly intermixed, I have entituled them *Extravagants*.

Now the former impression venting faster than I did expect it would, I was called upon for a second, my Condicion being no other than at first : to speak

B plain,

plain, I was still a Prentice, yet according unto the small measure of Time that my Ocasions would afford I have amended what was formerly amisse, plentifully enlarged it in every part, and collected a Table at the end for every Part. Of the ingenious and well disposed, I desire a favourable construction of these my Endeavours, and then if they meet with any light faults, to put them by as things incident to Works of this nature that pertayn to the Presse, especially when the Authors have no time to bee at hand to peruse them over. As for others, what I have said formerly, I say again; it is booteſſe for me to desire of them what the best deserving could never obtain. Farewell.

Your well-wishing Friend,

JOHN BATE.

To the ingenious Author, I. B.

Kinde freind, thy worth and fame I mast admire,
In whom both Art and nature so conspire
An happy Progenie. And sith the time is come,
A second burthen delivered by thy womb,
To solemnize the birth, and to expresse
My Ioy, my Love, and eke my thankfulnesse:
I'le be its witnesse tis no base born brat,
Or father'd onely, not legitimat:
Thy unkown painfull travaille [shew's twas thine]
By birth, thy care from faults it to refine.
Twas naturall, tis youthfull all may see,
Tis active and ingenious like to thee.
Free-born, though forc'd to serve a prestiship
Of Sev'n years toyle, in which thy wrong did nip
Its taller growth, and marrd it's fayrer feature,
Blasting the buds of thy rath-ripe Nature.
But, time'll befreind thee, and spur on a pace
To do thy vertues right, and publique grace:
And thrice welcome to all may that day be,
which shall thee blesse with joy of beeing free.
Though sure such skill in secrets mysticall,
Proclaim thee not to be illiberal
Thy work doth speakit self, and needs no praise
Of hired Poetry in some beggning phraise
To catch thy Readers. Ne, thy well-pen'd stile
Of things, not words, do better grace it is pile.
Peace then my prating Muse, forbear to spread
Riddles not understood till they be read.
And rather pray heaven blesse them with successse,
These Elementis may safely passe the Presse,

And

And being come abroad, as welcom be
Again to all the world, as now to me.
And so (dear Friend) I wish thy Book may sell,
All may have it, that all may so farewell.

Thine unsainedly affectionate,

Jos: BERNARD.

To his friend I. B. upon his Treatise of
Art and Nature,

O That Apelles lived now! then he
Might draw thee to the life, but alas we
Must not attempt that which the Painters Art
Can onely doe: but what, the Painters Art
Said I? that can't; no colours but thine own
Can thee expresse, nor yet can Art be shwon.
In any but thy selfe: for thou art he
Whom Nature joyn'd with Art, doth dignifie,
Therefore when I through evry leaf descry
Thy Engines, and in each his property,
I can't deny but that there's both in one:
There's Art, there's Nature, whom thou knew'ſt alone
To joyne; or else in Art hath any been,
Or Natures Treatise better then thee seen?
whom thine own book here shewes, and in which you
Lie open to each censure, and each veim,
Tea to each curious eye. But what of that?
we'll thee (in spight of them) perpetuat,
And carpat carpers, and yet still comprise
Thy vertues, in our annual memories.

T. T.



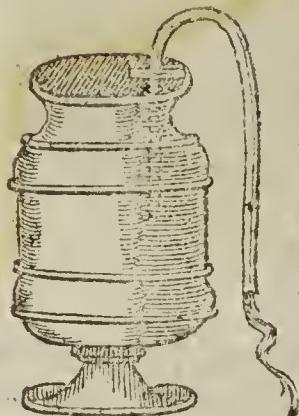
Of Water-works.

Thāt hath been an old Saying amongst Philosophers, and Experience doth prove it to be true, *Non duratur vacuum*, that is to say, *Nature will not admit of any vacuity or emptinesse*: For some or other of the Elements, but especially Ayer, and Water do insert themselves into all manner of concavities or hollownesses, in or upon the Earth, whether they are such as are formed either by Art or Nature. For the one it is so obvious and manifest, as that it needs not any prooфе at all. As for the other, I shall make it manifest unto you by easy Demonstracions: Let there be gotten a large vessell of glasse, or other, having besides the mouth another hole (though but a little one) at the top: pour water into the vessell by a Tunnell thrust into the mouth of it, and you shall finde that as the water runneth into the vessell, a winde will come forth of the little hole, sufficient to blow out a Kandle being held over it. This proveth, that before the water was poured into the vessell (though to our sight it appeared to be empty) it was full of Ayer, which was forced out of the vessell as the Water ran in; and the reason hereof is, because the Water is by nature of a massie, subtil, substance; and the Ayer of a windy, light, evaporative nature: The knowledge of this, with the rarifaction of inclosed Ayer, is the ground and foundacion of divers excellent Experiments, not unworthy the knowledge of any ingenious Artist whatsoever.

How to draw Water by a Crane.

TAke any vessell, of what bignesse you please, fill it with Water, then take a Crane (that is, a crooked hollow Kane)

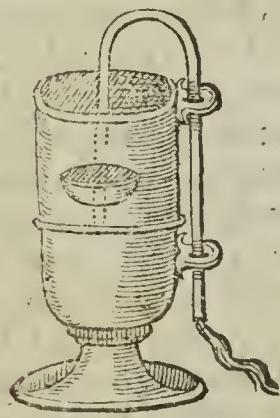
WATER-WORKS.



let one End thereof bee somewhat longer than the other ; put the shorter end of it into the vessell of Water, and let the longer end hang out of the vessell, unto which longer end put your mouth , and draw in your breath, and the Water will follow ; then withdraw your mouth, and you shall see the Water run so long, till it come equall with that end of the Kanc which is within the vessell.

Another.

TAKE a deep Vessell having two loops on one of the sides, fill it nigh full with Water ; then take a hollow Kanc like unto the aforesayd, but let there be fastened unto the shorter end a wooden dish ; put the longer end thereof thorow the loops on the side , and that end which hath the Dish fastened unto it into the Vessell of Water ; and then with your mouth (as you did in the former) draw out the Ayer, and you shall see that as the Water runeth out, the Crane will sink lower and lower , and so will continue runing untill the Vessell be drawn empty.



How to make a conceited pot, which being filled with water, will of it selfe run all out ; but being not filled quite, will not run out.

MAKE or cause a pot to be made, of what fashion you like best, and make a large hollow Kanc to stand up in the midst thereof, having at the bottom two or three small holes ; let the top of this Kanc be close : then make a hole in the bottom of the Vessell, and put up a little Kanc hollow at both ends, into the other Kanc, so that the one end thereof may almost touch the top of the great Kanc, and it is done. Note, that if you put into this Vessell so much liquor, that it may

swim

WATER-WORKS.

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swim above the top of the Kane, it will of its own accord run, and never cease so long as there is any liquor in the Vessell; but if you fill it below the Kane, it will not run at all of it selfe: the reason whereof is this; the Ayer being the lighter Element, doth ascend into the higher place, but being drawn as in the two first Demonstrations, out of the Crane, or forced, as in this, by the waight of the Water in the Vessell, the Water then tendeth downwards unto its proper place.



Another conceited Pot; out of which (being first filled with Wine and Water) you may drink pure Wine apart, or fair Water apart, or else both together.

Let M signify a pot having a particion in the middle, as you may see in the Figure; which must have divers little holes bored thorow: the handle of this pot must be hollow quite thorow; and the lower end thereof must passe thorow the side of the Pot, and also thorow the particion that is within the Pot: It is noted with the letters q and r. If you fill the lower part of this Pot with Water, and then with your finger stop the hole r at the top of the Handle, and then fill the upper part with Wine, neither of both will mix together: But if you withdraw your finger from the hole r at the top of the Handle, you may drink out of the sayd Pot both Wine and Water mixed together. With this Pot you may welcom unbidden Guests, having the lower part ready filled with Water, call to your servant to fill your Pot with Wine, then you may drink unto your Guest, drinking up all the Wine, who when he takes the pot thinking to pledge you in the same and finding the contrary, will happily stay away untill he be invited, fearing that his next presumption might more sharply be rewarded.



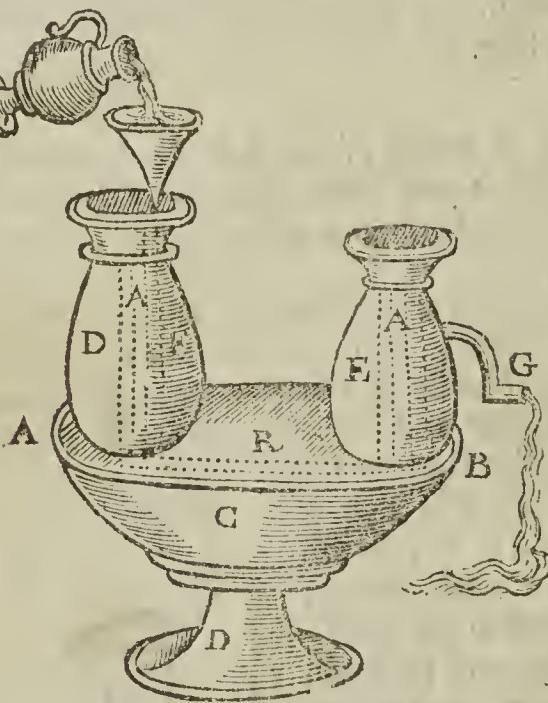
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WATER-WORKS.

How to dispose of two Vessels upon one foot, that so much Wine may run out of the one, as you shall put water into the other.

Let A B C D be the foot, at each end whereof place two Vessells equall in bignesse the one to the other, as D E; also let there passe a hollow Kane from the one to the other, as A R A, the ends whereof must almost touch the tops of the sayd Vessells: in the Vessell D there must bee a

hollow pipe, as F, whereby you may by help of a Tunnel pour water into the vessell; also in the vessell E there must be a Crane as G. The mouth of the vessell D must bee close stopped, and the pipe F must passe thorow the stoppell: Now if you fill the vessell E with Wine almost unto the top of the Crane and afterwards stop the mouth of the Vessell, that the Ayer may not breath forth, it will not

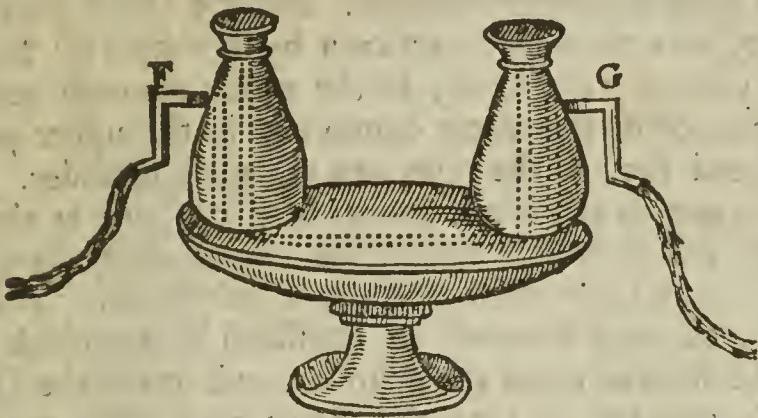


run of it selfe: but if you put Water into the vessell D, the Ayer contayned in it, will passe thorow the hollow pipe A R A into the vessell E, where striving for a greater quantity of room, it presseth the wine out of the vessell E (by the Crane) answerable in quantity unto the Water poured into the vessell D.

How to dispose two Vessells upon one foot, the one being empty, and the other almost full of Wine, and yet shall not run out of the vessell, unlesse you fill the empty vessell with Water, and then the one shall run pure wine, and the other fair water.

Let there be two Vessells placed upon one foot, having a hollow Kane passing from one to the other (as I taught in

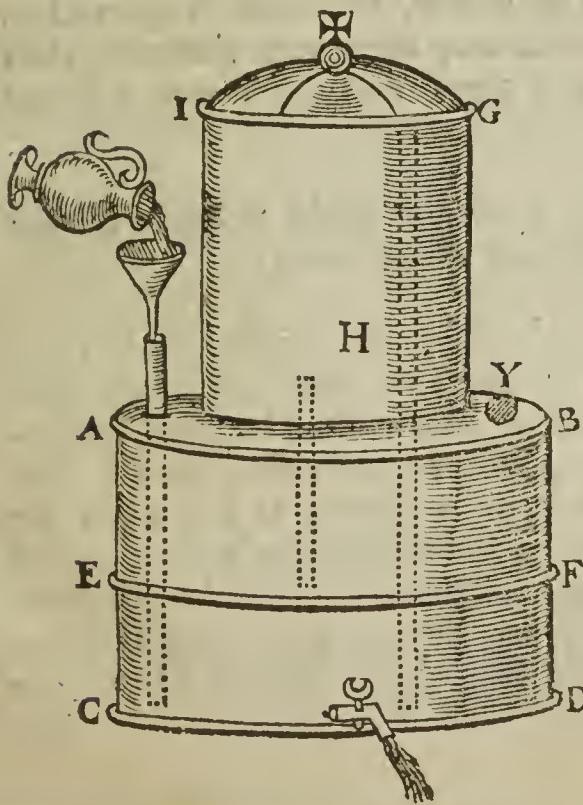
in the precedent Problem) but let there bee two Cranes, as F G, one in each vessell ; then fill one of the vessels with Wine, but not above the Crane, so it will not run of it



selfe : but if you pour water into the other vessell untill it be full, it will cause that Wine shall run out of the one, and clear Water out of the other.

To make that the water contayned in one vessell, shall ascend into another vessell placed above it.

Let A B C D signify a vessell having a particion in the middle, as E F, let there be placed upon this vessell a Cylinder of Glasse, clear & very transparant, that will contain the same quantity of water, that the one of the particions will, as I G H ; and in the lowermost particion towards the bottom, let there bee a Cock ; and out of the same vessell let two pipes be made to passe, the one whereof reaching almost to the top of the Cylinder, the other must come out by the side of the Cylinder: also out of the upper



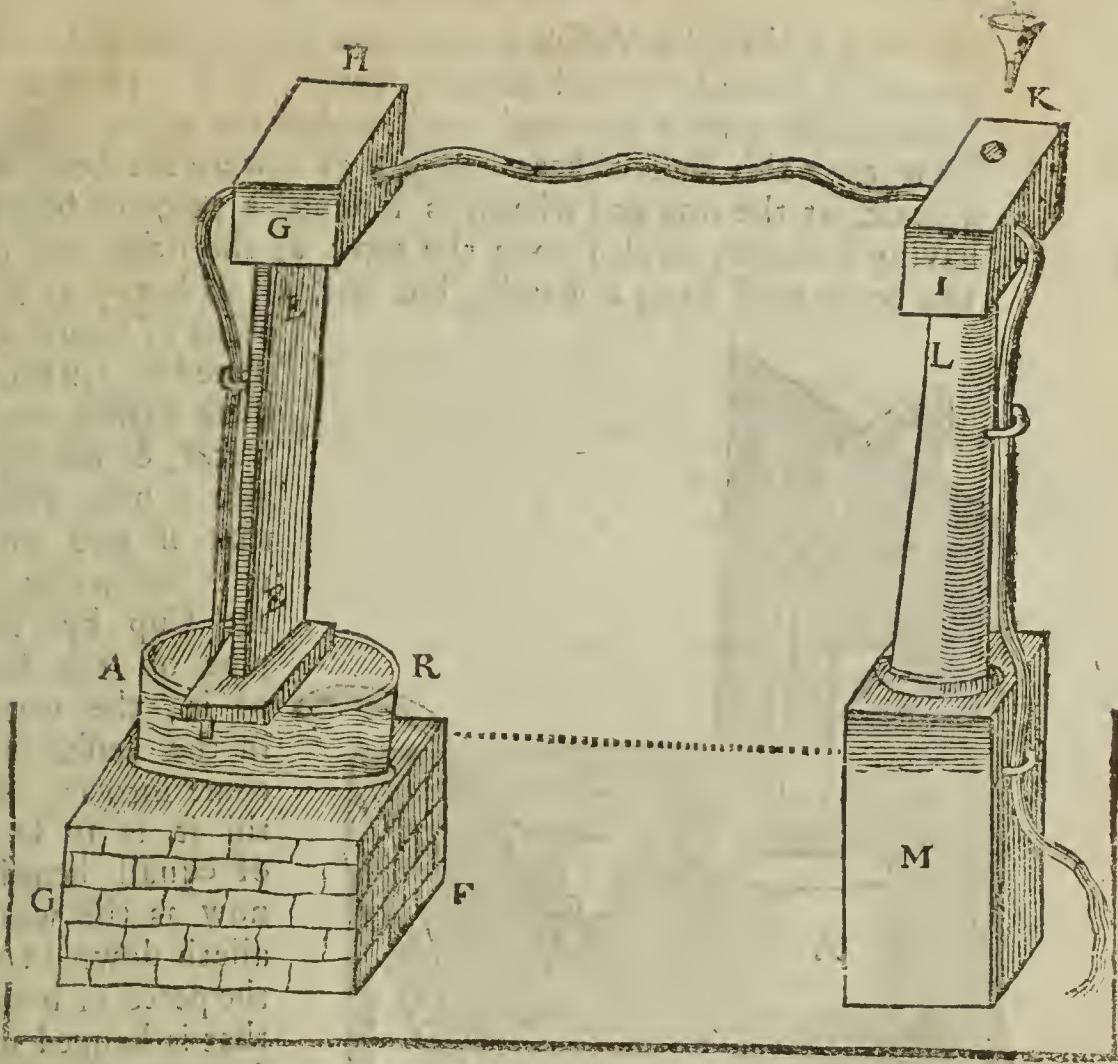
per particion there must come another pipe : Moreover, there must be a hole thorow the top of the uppermost particion as Y ; which, (so soon as the upper particion is filled with Water) must be closely stopped. Fill the lower particion at the pipe, also the upper particion by the hole Y : Note then that if you turn the Cock, as the water runneth out of the lower particion, the water contayned in the upper particion will ascend thorow the pipe into the glass cylinder. When all the water in the lower particion is run out at the Cock, then the water which before did ascend into the cylinder, will fall back again into the upper particion. After this manner you may compose an artificiall Water-clock, if you mark the houres upon the cylinder, and make the Cock after such manner as that the water may issue out but by drops.

How to convey Water over a Mountain

THIS Experiment is as easie to be performed as any of the former, and indeed after the same manner, for you most lay a pipe of lead over the Mountain with one end in the Spring or water that you desire to convey, and the other end must lie somewhat lower then it : then open the pipe at the top of the Mountain ; stop both the ends of the pipe, and with a Tunnell fill the pipe full of Water, then close it up exactly, that neither Ayer nor Water may come out thereat : then unstopp both the ends of the pipe , and the Water will run continually.

How to make the Water of a pit continually to ascend without strength or assistance of any Pump

LE A B C D be the pit out of which you would cause the Water to ascend : let there be a piece of Timber layd overthwart over the top of it, and in that let there be another piece of Timber fastened, as E F: upon the top of it place a Cestern , as G H ; place also a Cestern as I K upon the piller L M, answerable to the aforesaid Cestern G H : then make a pipe to come out of the Cestern G H, and reach down into the pit : also make another pipe to come out of the Cestern I K, and to descend by the side of the pillar L M: and to the



the lowermost end let there be fastened a Cock, and this end must descend lower then the end of the other pipe : then make another pipe to passe from one Cestern to the other, and its done. When you would occupy it, fill the Cestern I K, full of water with a Tunnel , and stop it afterwards close with a Kork ; then turn the Cock, and as the Cestern I K emptieth, it will bee supplied by the water in the Cestern G H ; and as G H emptieth, it will be supplied by the wa-
ter in the Well or Pit .

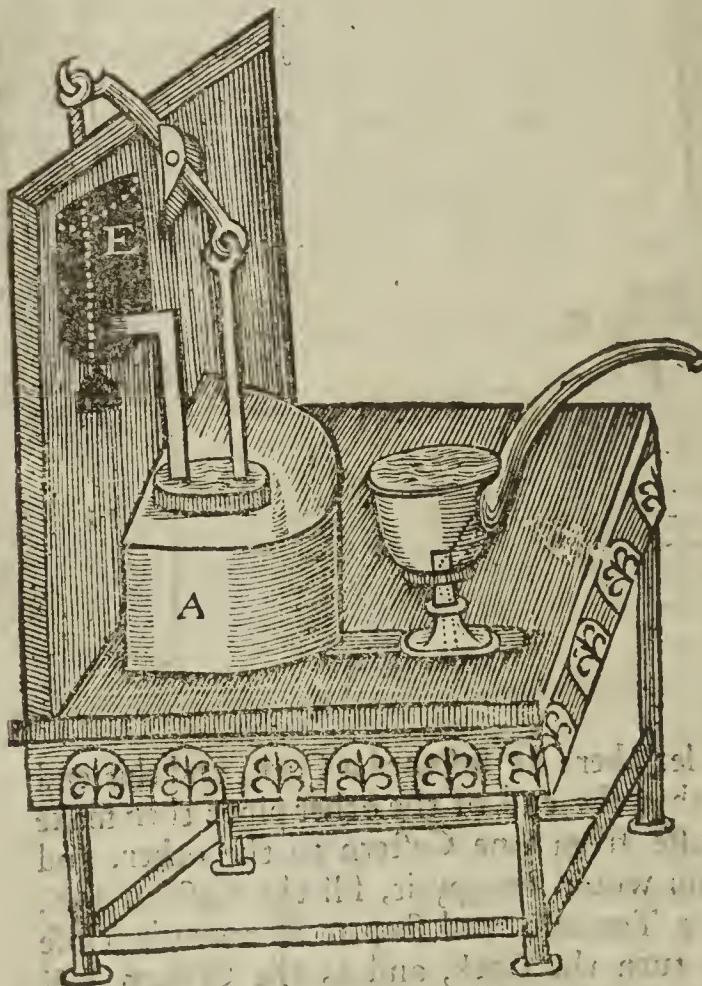
*To make a Cup or Vessell that so oft as you take the liquor out
of it, so oft it shall fill it selfe, but never run over.*

Suppose A to bee a Vessell full of water, having a pipe
comming from the bottom, and rising up into a Cup of the
C 2 just

just heighth that the Vessell is of ; over the Vessell fild with water, let there be placed another Vessell, as E. From this Vessell must come a pipe and reach within the other Vessell. Now over this Vessell there hangeth as it were the beam of a Scale, at the one end wherof is fastened a peece of boord having a leather nayled upon the top: at the other end of this beam must hang a waight, but not full so heavy as the

peece of boord lethered is. Fill both these Vessels with water, & the Cup also : note then, that if you suck out the water in the Cup by the pipe on the side of it, the water in the vessell will come into it, untill it is in both of equall heighth : now as the water alleth down in A, the peece of boord that is hanged unto one end of the beam falleth after it (because it is heavier than the waight) and so giveth way unto the water in E,

which runneth into it : and when the Vessell is filled again with water, it beareth up the sayd peece of boord against the pipe of the Vessell E, so that the water can run out therat no longer, except the water bee again drawn out of the Cup.



Of drawing Water by Engins.

Before I begin with these, take a word or two by the way. Let it be a generall Notion, that no Engine for Water works of what sort soever, whether for service, or meere pleasure, can be made without the help of Suckers, Forcers, or Clacks; every of which, I have orderly explained both by words and demonstrative figures

A Sucker is a Box, which is made of Brasse (having no bottom) in the middest of which, there is a small Bar that goeth crosse the same, having a hole in the middle of it; this Box hath a Lid so exactly fitted unto it, that being put into it, no Ayer nor Water can passe between the crevise: this Lid or Cover hath a little button on the top, and a stem that goeth into the Box and so thorow the hole of the aforesayd crosse barre, and afterwards it hath a little button riveted on it, so that it may with ease slip up and down, but not be taken or slipt quite out.



A Forcer is a plug of wood exactly turned and leathered about; the end that goeth into the barrell, is semicircularly concave.



A Clack is a peece of Leather nayled over any hole, having a peece of Lead to make it lie close, so that the Ayer or Water in any Vessell may thereby be kept from going out.



How to harden Leather, so as the same shall last much longer in Suckers of Pumps, than it doth unprepared

Lay such Leather as is well tanned to soak in water, wherein there hath been store of yron fileings a long time, or else in the water that hath lien a long time under a grindstone, into the which such yron as hath been from time to time ground away, hath fallen and there settled

The making of a pump to draw Water

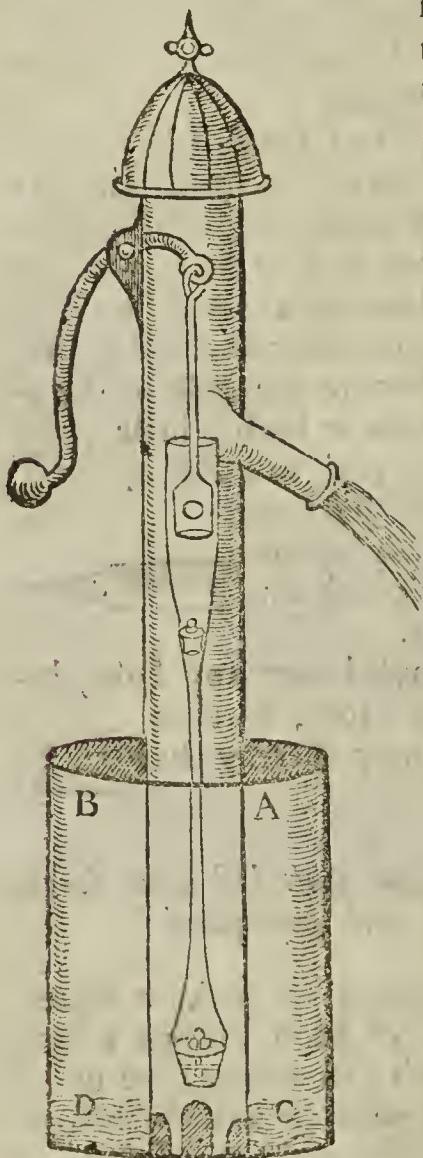
Suppose A B C were a deep Well, wherin you would make a Pump to draw water to the surface or superfi-

cies of the Earth. First therefore you must provide a pipe of Lead, or a piece of Timber bored thorow, so long as will reach unto the bottom of the Well: that part that standeth in the water must bee cut with two or three arches, as it were, if it be wood; if Lead, it must have somewhat to bear

it a little from the bottom, that the water may thereby be let into the pipe. Towards the bottom of the pipe in the water there must be fastened a Sucker: also another of these Suckers must bee fastened about two foot above the top of the ground: then have a Bucket fitted unto the hole of the wooden or leaden Pipe, let it bee well leathered about, and have a Clack at the bottom of it, and let it be hanged with a Sweep as the figure shewes: Note, that after you have filled the distance between the lower Sucker and the Bucket with water, that if you lift up the Sweep, it will thrust down the Bucket upon the water, and presse it, the water being pressed upon by the Bucket, beareth up the Clack that is fastened in the bottom of the Bucket, and so comes into the Bucket: then if you pull down the Sweep, the Clack shutteth, and so the water remayns in the Bucket, which being drawn upward, there being nothing to follow but water, both the Suckers open, and there commeth into the Pump so

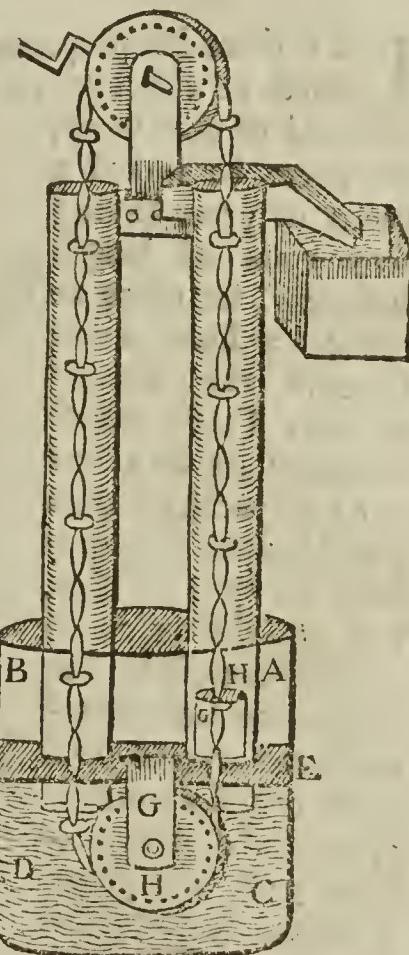
much water as the Bucket drew up: so soon then as you lift up the sweep again, the water beareth up the Clack again, and there being no place for the water formerly contained in the Bucket to fall back into, it must of necessity rise above the Bucket, and so seek for a passage some other where.

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The making of an Engin, whereby you may draw Water out of a deep Well, or mount any River water, to be conveyed to any place within three or four miles off the same. Also it is used in great Ships which I have seen.

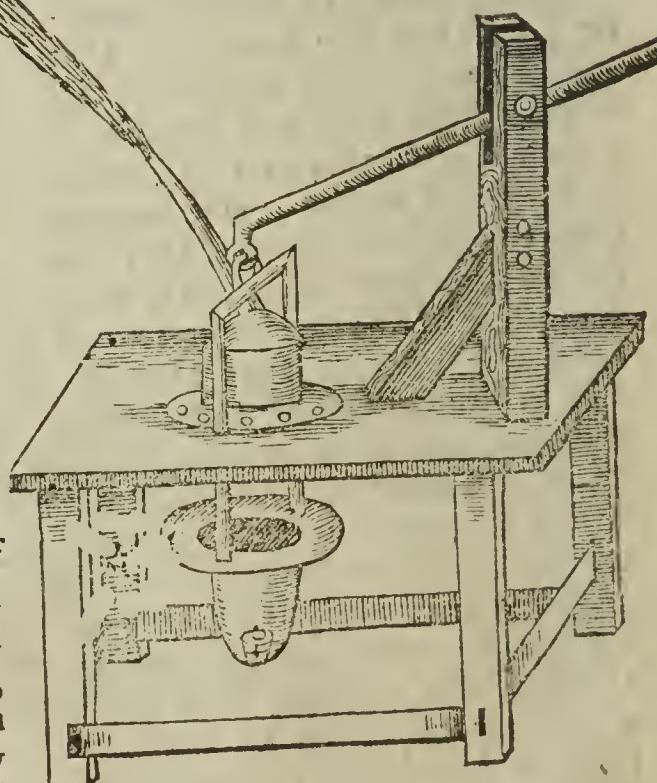
Suppose A B C D to be a deep Well, and E F to be a strong peece of Timber fastened athwart the same, a good way in the water. In this Plank let there be fastened a peece of Timber with a strong wheel in it, as G H, having strong yron Spikes drove athwart the wheel within the crevise, and strongly riveted on each side ; let them be three or foure inches distant from each other. Let there be likewise made in the sayd Plank two holes, in which set two hollow Posts, that may reach to the top of the Well, or so much higher as you desire to mount the wa-
ter ; let them bee made fast that they stir not. In the bottom of one of these Posts there must be fastened a Barrell of Brasse, as G H, made very smooth within ; and betwixt those two Posts at the top, let there bee fastened unto them both, another peece of strong Timber to hold them fast, lest they start asunder : and in the middest of that make a Mortice, and in it fasten a strong
peece of Timber with a wheel like to the former mencioned, the pin whereof ought to be made fast unto the wheel, and have a crooked Handle to turn about, that by turning of it you may turn the wheel also. Then provide a strong yron Cliayn of length sufficient, having on every third or fourth link a peece of horn that will easily go thoro the Brasse Barrell, and a leather on each side of it, but somewhat broader then the horn : put this Chayn under the



lower wheele in the Well upon both the hollow posts, draw it over the upper wheele, and linke it fast and straight, turn then the Handle round, and it will turn the chaine round, whose Leathers comming up the brasse barrell, will beare the water before them ; this goeth very strongly, and therefore had need be made with wheelles & wrought upon by horses, for so the water is wrought up at Broken Wharfe in London.

To make an Engine, which beeing placed in water will cast the same with Violence on high

Let there be prepared a strong Table, with a sweep fastened at the one end thereof, to lift up & doun : unto the end of the Sweep, let there be linked a peece of yron having two rods of length sufficient, let there be made a hole quite thorow the middest of this Table, whose diameter let be about 5 or 6 inches : then provide two peeces of brass in form of hats, but let the brim of the uppermost be but about one Inch broad and have divers little holes round about it : also in the crown of this must be placed a large Sucker, and over it a half globe, from the top of which must proceed a hollow trunk about a yard long and of a good



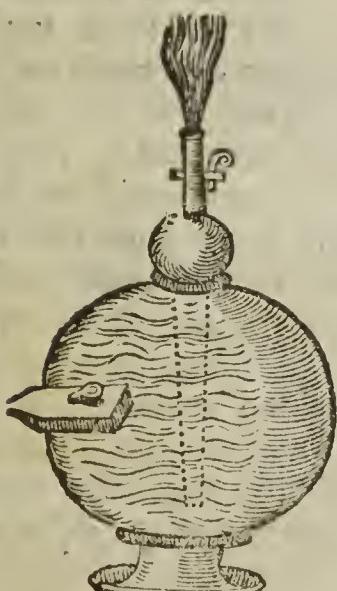
wide bore, then take good liquoured leather, 2 or 3 times double, and put between the boord and the brims of this, and with divers little screws put thorow the holes of the brim, screw it fast unto the top of the Table. Note that the Table must be leathered also underneath the compasse of the brim of the lower Brasse. Now the lowermost Brasse must be equall diameter (in hollownesse) unto the other, but it must be more spirall towards the bottom, and must have either a large Clack or Sucker fastened in it: also the brim of this must bee larger then that of the uppermost, and have two holes made about the midst, on each side one: bore then two holes in the Table, on each side of the brasse one, answerable unto the holes of the brim of the lower brasse, thorow which holes put the two rods of the yron hanged unto the Sweep, and rivet them strongly into the holes of the lower brasse, place this in water, and by moving the Sweep up and down, it will with greater violence cast the water on high.

Experiments of forcing Water by Ayer compressed.

Let there bee a large Pot or Vessell, having at the side a peece of wood made hollow, having a Clack of Leather with a peece of Lead upon it: within the vessell also let there bee a pipe thorow the top of the vessell, reaching almost to the bottom of it: at the top of which let there bee a round hollow Ball, and on it a small cock of Brasse. Note that if you fill the sayd vessell halfe full of water, and blow into the hole of the pipe, at the side, your breath will lift up the Clack, & enter

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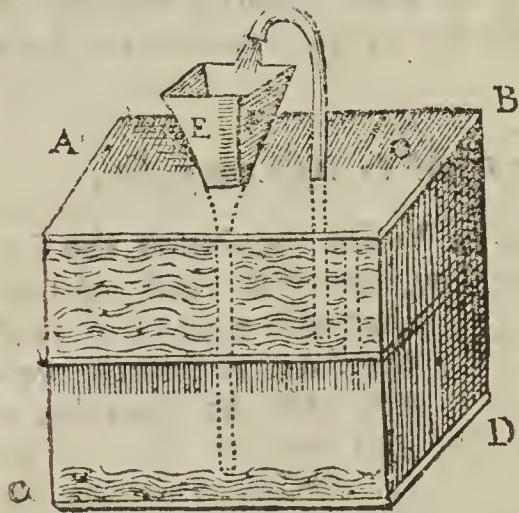
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the vessell, but when it is in, it will presse down the Clack: blow into it oftentimes, so shall there be a great deale of Ayer in the vessell, which will presse so hard upon the wa-ter, that if you turn the cock at the top, the water in the vessell will spinne out a good while.

Another.

Let A B C D be a great Vessell, having a particion in the middle: let there bee a large Tunnell at the top of it, as E F, whose neck must go into the bottom almost of the lower Vessell: let there be a hollow pipe also comming out of the particion, and almost touch the top of the upper Vessell. In the top of the upper Vessell let there bee another pipe reaching from the bottom of the upper vessell, and extending it selfe out of the vessell a good way: let the top of it hang over the Tunnell. In the top of the upper vessell let there be a hole besides, to bee stopt with cork or otherwise: when you will use it; open the cork hole, and fill the uper vessell with water,

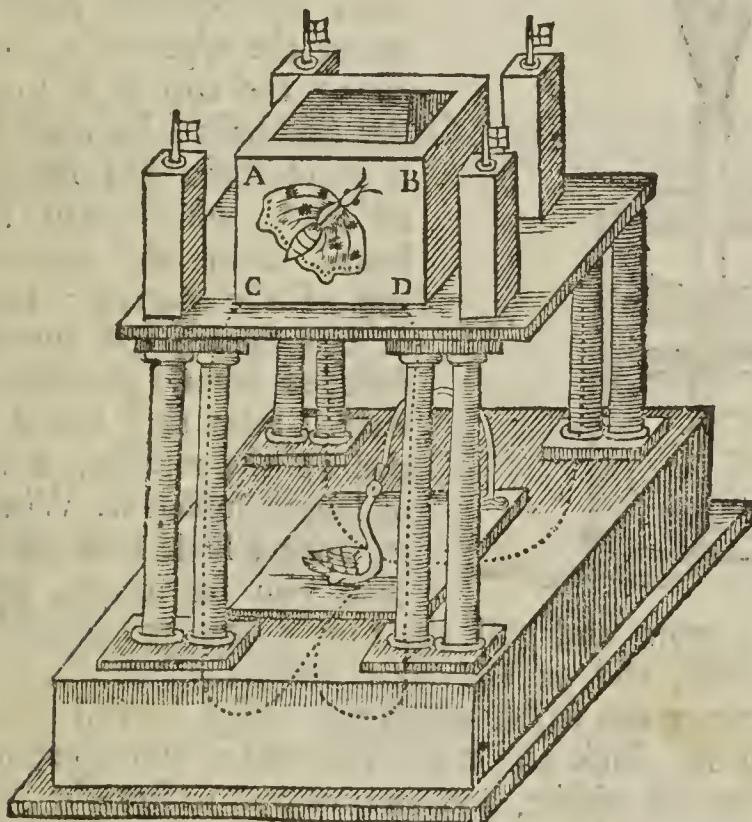


then stop it close again, and pour water into the Tunnell, and you shall see that the water in the upper vessell will run out of the pipe into the Tunnell again, and so will continue running untill all the water in the upper vessell be run out. The reason thereof is this; the water in the Tunnell pressing the ayer in the lower vessell maketh it ascend the pipe in the particion, and presse the water in the upper vessell, which having no other way but the pipe, it runneth out thereat

The

The forcing of Water by pressure, which is the naturall course of Water in regard of its heavinessse and thinnesse, artificially contrived to break out of what Image you please.

Let A B C D be a Cestern placed upon a curious Frame for the purpose, and let the bottom of this Frame bee made likewise in the form of a Cestern : thorow the pillers of this Frame let there passe hollow pipes from the bottom of the upper Cestern, and descend to the bottom of the lower Cestern, and then run all to the middle thereof, and



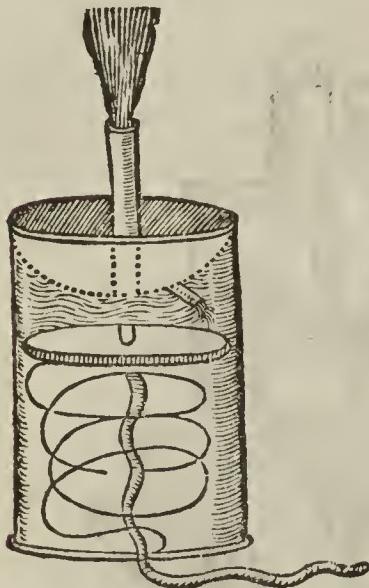
joyn in one, and turn up into the hollow body of a Beast, Bird, Fish, or what your fancy most affecteth : let the hole of the Image whereat the water must break out, bee very small, for so it will run the longer. Fill the upper Cestern with water, and by reason of the waight thereof it will passe thorow the pipes, and spin out of the hole of the Image.

Experiments of forcing water by Engins.

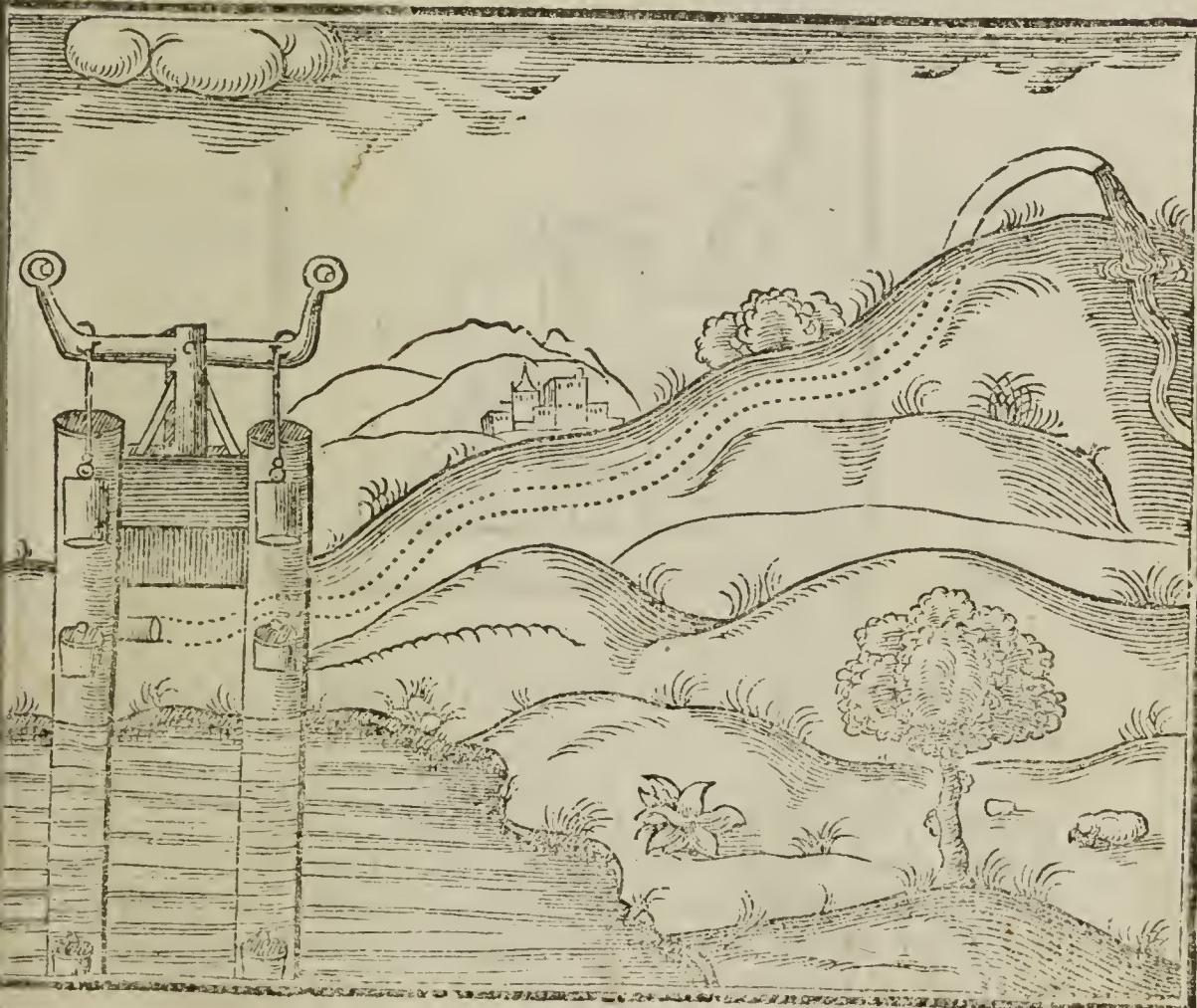
Let there be an yeven straight Barrell of brasse of what length and bignesse you please : let the bottom of it be open, and let the top be closed, but so that it be hollow on the out side like a bason : in the midst whereof let there be a straight pipe erected, open at both ends ; also let there be another short pipe at the side of it, which let be yeven with the top of the bason on the outside, but stand a little from it on the side. Having thus prepared the Barrell, fit a good thick board unto it, so that it may slip easily up & down from the top of the Barrell, unto the bottom, nayl a leather about the edges of it, and another about the top of it : on the under side of it, let there be fastned a good stiffe, but flexible Spring of steel, which may thrust the board from the bottom to the top of the Barrell : let the foot of this Spring rest upon a barre fastened acrossse the bottom of the Barrell : let this board also have tied at the middle, a little rope of length sufficient. When you use it, bore a little hole in the Table that you set it on, to put the rope thorow and pull the rope down, which will contract the Spring, and with it draw down the board : then poure in water at the bason untell the vessell be full : Note then, as you let slack the rope, the water will spirt out of the pipe, in the middle, and as you pull it straight, the water will run into the vessell again. You may make Birds, or divers Images at the top of the pipe, out of which water may break.

Another manner of forcing water, whereby the water of any Spring may be forced unto the top of a Hill.

Let there be two hollow posts, with a Sucker at the bottom of each, also a Sucker nigh the top of each : let there

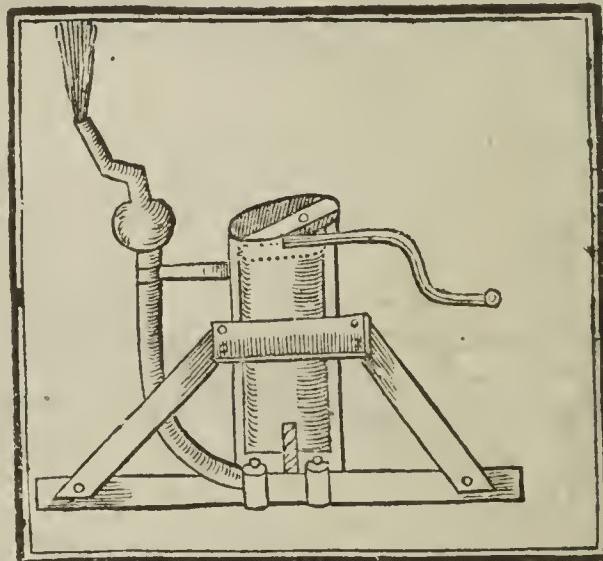


there be fastned unto both these posts a strong peice of Timber, having, as it were, a Beam or Scale pinned in it, and having two handles, at each end, one. In the tops of both these hollow posts fasten two brasse Barrels, made very even and smooth within ; unto these two Barrels let there be fitted two Forcers, leathered according to Art, at the tops of these Forcers, must be fastened two yrons, which must be linked unto the afore said Beame ; from each post below towards the end of the Barrells, let there bee two leaden pipes, which afterward meet in one, to conduct the water up to the place desired, which if it bee very high, there will bee need of some Suckers to catch the water as it commeth.



The description of an Engine to force water up to a high place; very usefull for to quench fire amongst buildings.

Let there be a brasse Barrell provided, having two Suckers in the bottom of it : let it also have a good large pipe going up one side of it, with a Sucker nigh unto the top of it, and above the Sucker a hollow round Ball, having a pipe at the top of it made to screw another pipe upon it, to direct the water to any place. Then fit a Forcer unto the Barrell with a handle fastened unto the top ; at the upper end of this Forcer drive a strong screw, and

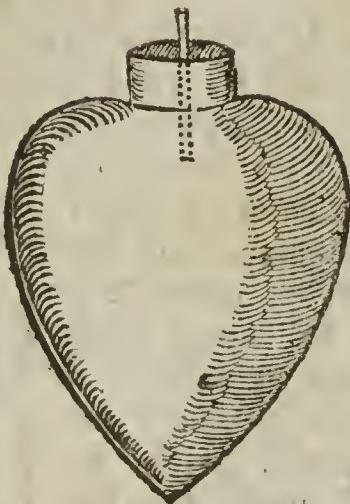


at the lower end a screw Nut, at the bottom of the Barell fasten a screw, and at the bar that goeth crosse the top of the Barrell, let there be another screw Nut : put them all in order, and fasten the hole to a good strong frame, that it may stand steddy, and it is done. When you use it, either place it in the water, or over a kennell, and drive the water up to it, and by moving the handle to and fro, it will cast the water with mighty force up to any place you direct it.

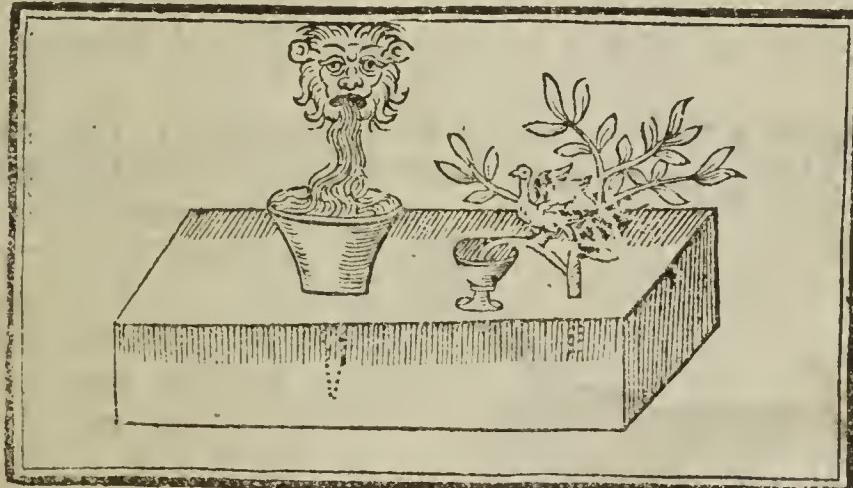
Experi-

Experiments of producing Sounds by Ayer and Water.

Let there be had in a readinesse, a pot made after the form of a Heart having a little hole at the top, in the which fasten a Reed or Pipe, also another little hole at the bottom : presse this Pot into a Bucket of water, and it will make a loud noyse.

*Another*

Let there bee a Cestern of Lead or such like, having a Tunnell on the top : let it be placed under the fall of a Cundit, and at the one end of the top let there come

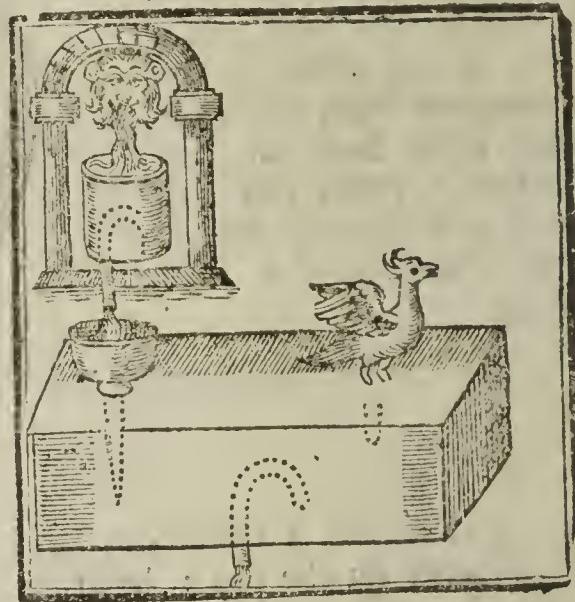


out of the vessell a small pipe, whch let be bent into a Cup of water, and there will be heard a strange voyce. Over this pipe you may make an artificiall Tree with divers Birds made to sit therein..

Hem.

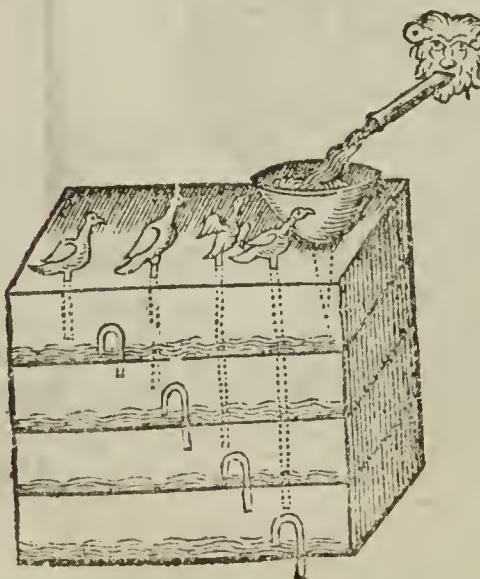
How to make that a Bird sitting on a Basis, shall make a noyse, and drink out of a Cup of water, being held to the mouth of it.

Provide a Cestern having a Tunnell at one end of the top, and a little Kane comming out of the other end of the vessell ; on the top of which let there be a Bird made to sit : also at the bottom of the Cestern, let there be a Crane to carry away the water as it runeth into the vessell. Place this Vessell with its Tunnell under the fall of a Cundit of water, and the Bird will sing ; and if you hold a cup of Water under his Bill, he will drink and make a noyse.



A Device whereby severall voyces of Birds chirping may bee heard.

Prepare a Cestern haviug divers particions, one above another ; let them all have Cranes in the bottoms to carry the water form one to another ; also let each Cestern have his severall pipe, all of them comming out at the top of the Cestern, on whose tops let Birds bee artificially made , with Reeds in them : also in the top of the upper Cestern let there be a Tunnell. Place it under the fall of a Cundit of water, and you shall heare so many severall voyces as there are Birds,



A Device whereby the figure of a man standing upon a Bass, shall bee made to sound a Trumpet.

Prepare a Cestern having within on the Lid a concave hemisphere fastened, in whose bottom let there be made one or two holes : let there also be a hole in the top of the sayd Cestern, whereby it may bee filled with water a occasion serveth : also let there bee made to stand on the top of this Cestern the imimage of a man holding unto his mouth a Trumpet : this imimage must likewise have a slender pipe comming out of the Cestern unto the Trumpet, and in this Pipe or Kane there must bee a cock nigh unto the Cestern. Also there must come out of the concave hemisphere at the side of the Cestern, a little short pipe having a Clack on it within the Vessell. Fill the Cestern about two thirds full of water, and then cork it up fast ; blow then into the vessell at the pipe on the side divers times, and the Ayer will force the water out of the hemisphere, and make it rise up on the sides of it : turn then the cock, and the waight of the water will force the Ayer out of the pipe, and so cause the Trumpet to sound.



Hercules shooting at a Dragon, who as soon as hee hath shot, hisseth at him.

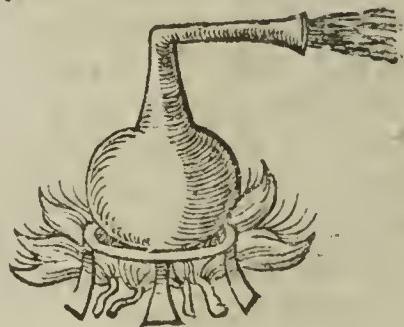
Let there be a Cestern having a particion in the middest, in the particion let there bee a deep Sucker, having a

small Rope fastened unto the top of it : let one end of the Rope come out of the upper Lid of the Cestern, & be fastened unto a Ball, the other part thereof let it be put under a Fulley (fastned in the particion) and let it be carried also out of the upper Cestern, and be fastened unto the Arm of the Image, which must be made to slip two and againe, and to take hold of the string of a steele Bow that is held in the other hand. At the other end of the Cestern let there bee made an artificiall Image of a Dragon, thorow whose body must come a smoll pipe with a reed artificially fastned in the upper part thereof. Note then, that when you put up the Ball, the Image will draw his Bow, and when you let it fall, the Dragon will hisse



*Experiments of producing sounds by evaporacion
of water by Ayer*

Prepare a round Vessell of Brass or Latten, having a crooked pipe or neck, whereunto fasten a pipe : put this Vessell upon a Trevet over the fire, and it will make a shrill whistling noyse.



To make two Images sacrificing, and a Dragon hissing.

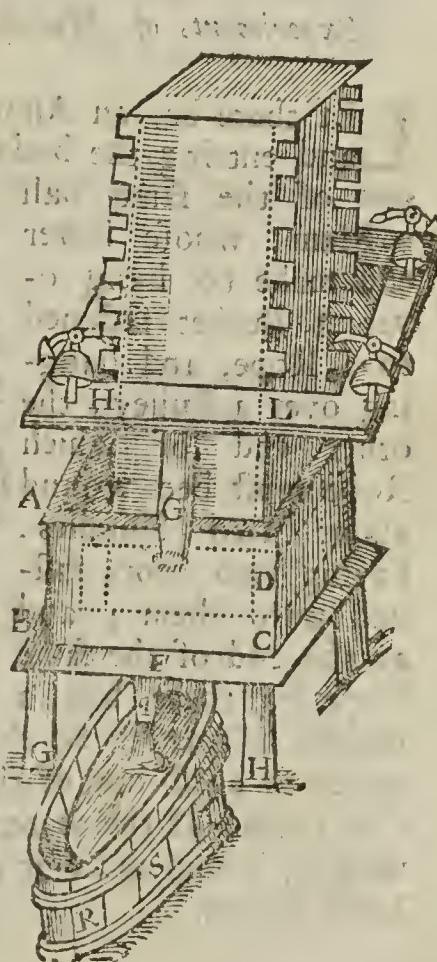
Prepare a Cestern having an Altar of Brass or Tin upon it, and let there be in the Cestern a hollow pipe turning up out of the Cestern at each end, also in the middle with-

in

in the Altar, also on the side of the Altar into the body of a Dragon artificially made, with a Reed in the mouth of it. Let there be two Boxes at the tops of the pipes, on the ends of the Cestern, having two crooked pipes or Cranes comming out of them. Fill the Boxes with water when you occupy it, also put fire upon the Altar, and the Dragon will hisse, and the water in the two Boxes being wrought upon by the heat of the fire comming thorow the pipes, will drop into the fier. These two Boxes ought to bee inclosed in the bodies of two images, and the two short Cranes comming out of them, in her armes & hands.

Experiments of producing Sounds by Engins.

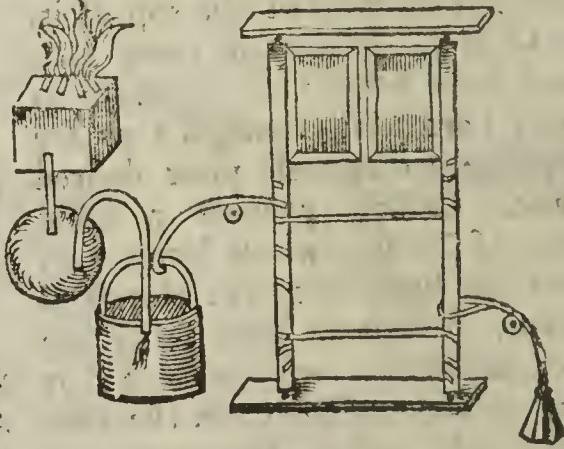
Prepare a Vessell after the form of the Figure marked with the letters A B C D: place it upon a Frame as F G H: this vessell must have a hole in the bottom, with a pipe fastened in it, as g, to convey the water contained in it into a vessell or Tub set under it, marked with the letters R S T: also a Frame must bee fastened at the top of it, as G H L, having so many Bels with little beaters or hammers to them (artificially hanged) as are requisite to expresse your desired Tune. Lastly, provide a sollid piece of Timber, whose lower part must bee fitted unto the aforesayd vessell, so that it may easily slip up and down, and so high, as that its foot resting upon the bottom of the vessell, the upper part thereof may stand somewhat above all the Bels. Note likewise, that that part of this wood above its bottom or foot, must be cut away about three quarters of an inch. Upon this wood (thus fitted) must



be fastened severall pins equall unto each Bell, from the top unto the foot thereof, so disposed that they may orderly presse down the inward end of the hammers of each Bell, according as the Tune goeth: when you use it, fill the Cestern almost with water, and put the fitted piece of Timber into it, and as the water runneth out at the bottom, it will play upon the Bells: note, that it were very requisite to have a cock fastened to the pipe on the bottom of the vessell, that therewith you might at your pleasure stay the water. The like Engines might be made to play upon wyer strings, disposed upon a concavous matter to make the muzyk resound: but because this Description giveth light enough for the framing of divers other, I did think good here to omit them.

Experiments of Motions by rarifying Water with Fier.

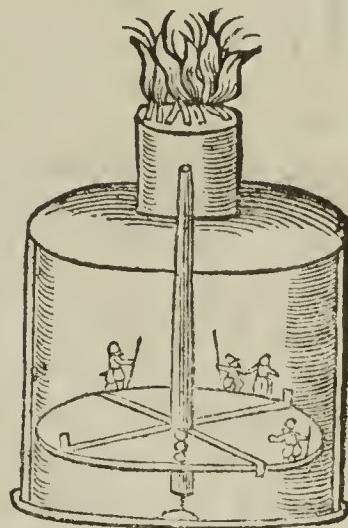
Let there bee an Altar having a pipe comming out of it Land entring the body of a hollow Ball, let there come out of the same Ball a Beam, whose lower end make to hang over a Bucket fastened to a Rope, and hanging over a Pulley, the other end of which Rope must bee wound about two Spindles, having two doors fastned unto them; and at the end of the same Rope let there bee a waight fastened: So the fier on the Altar will cause the water to distill out of the Ball into the Bucket, which when (by reason of the water) it is become heavier than the waight, it will draw it up, and so open the sayd gates or little doores.



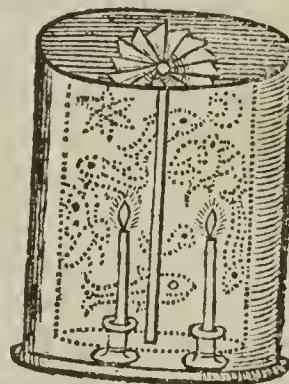
Experiments.

Experiments of Mocions by rarifying Ayer by Fire.

Let there be a round vessell of Glasse, or Horn, and on the top of it a vessell of Brasse, and in the middest a hollow pipe spreading it selfe into foure severall branches at the bottom : the ends of two of the branches must turn up, and the ends of two must turn down : upon these foure branches fasten a light Card, with severall images set upon it. Then rarify the Ayer by laying a red-hot yron upon the top of the Brasse or Tyn vessell, and it will turn the wheel about, so that you would think the immages to bee living creatures by their mocion.

*Another Way.*

First prepare a round piece of wood, having a bras Box in the middeit, such as they make to hang the Mariners Compass with, but a good deal bigger ; round about this peece of wood fasten divers shreds of thin Latten, standing obliquely or askew, as the figure doth repreſent : round about these fasten a coffin of thin pastboord, cut into severall formes of Fishes, Birds, Beasts, or what you please. Prepare a Lantern with oyled parchment, ſufficient to contayn it, in the middle of whose bottom must be erected a Spindle with a narrow point, to hang the pastboord (cut into forms) upon : and let there bee upon each ſide a Socket for to ſet a Kandle in ; also let there bee made a doore in the bottom to put the Kandles in at, and after to be shut, and tis done. If you ſet two Kandles in the Sockets, the heat of them will turn the whol pastboord of forms round.



A conceited Lamp having the Image of a Cock sitting on the Top, out of whose mouth by the heat of the Lamp either Water or Ayer may be sent.

Let e r be the foot of the Lamp, which must have a hollow pan of glasse or white Tin, to contain the oyl in, and whereon to put foure cotton lights, which may be made to swim by passing the wyer wherein they are fastned, thorow foure small pieces of cork. Now there must be a vessell of Brasse or Tin to be born over the lights with foure little pillars: you may make this vessell to seem to outward appearance, like a Crown: this vessell is noted with the letters *a b*, having a pipe marked with *c y*, reaching from the top of the vessell almost unto the bottom: this pipe must bee made flat on one side, and halfe round on the other, and unto the top thereof, must be sodered a round fillet of Brasse, as *M*, the bottom of this fillet must cover the top of the pipe noted with *c*: also it must hang over as much on the flat side of the pipe. Then let there bee made the image of a Cock, which must be hollow, and under whose belly there must come a pipe with a bottom sodered on it: this pipe must bee turned to sit even with the fillit *M*, so that neither Ayer nor water may come bee-tween their joyns: make then a small hole in the bottom of the fillet that is sodered on the pipe directly over the hole of the said pipe, *y*, also make such another hole in the bottom of the pipe that comes from the bellye of the Cock, so that it may answer unto the aforesaid hole in the bottom of the fillet *M*, then turn the Cock to the other side,



side, and with a double Bit make a hole both thorow the side of M, and also thorow one side of the pipe that comes from the Cocks belley. Lastly, you may make some hole whereat you may put water into the vessell, and to bee stopped up, and it is done. But observe this, that the pipe must first bee fitted, and afterwards fodered into the vessel, so as the vessell may give no vent but at the above mentioned holes in the said pipes

The larger you make this vessell towards *a b*, the more strange it will appear in its effects, so the Lights bee proporcionable. Fill the vessell halfe full of water, and set the Lights on fire underneath it, and after a short time, if you turn the holes that are on the sides of the pipes, that they may answer one another, the water being by little & little converted into Ayer, by the heat of the Lights that are underneath, will breath forth at the mouth of the Cock; but if you turn the mouth of the Cock the other way, that the holes at the bottom of the pipes may answer each to other, then there being no vent for the Ayer to breath out at, it will presse the water, and force it to ascend the pipe *y*, and issue out where the Ayer breathed forth before. This is a thing may move great admiracion in the unskilfull, and such as understand it not. Other Devices, and those more strange in their effects, may be contrived from hence.

Amongst all the Experiments pneumaticall; there is none more excellent than that of the Weather-Glasse: wherfore I have laboured to describe the making thereof as plainly as it possibly might be.

What the Weather-Glasse is.

A Weather-Glasse is a structure of at the least two Glasse, somtimes of three, foure, or more, as occasion serveth, inclosing a quantity of water, and a porcion of Ayer proporcionable; by whose condensacion or rarifaction the included water is subject unto a continuall mocion, either upward or downward; by which mocion of the water is commonly foreshown the state, change, and alteracion of the

the Weather. For, I speak no more than what my own experience hath made me bold to affirm ; you may (the time of the year, and the following Observacions understandingly considered) bee able certainly to foretell the alteration or uncertainty of the weather a good many houres before it come to passe.

Of the severall sorts and fashions of Weather-Glasses.

There are divers severall fashions of Weather-Glasses, but principally two.

- 1 The Circular Glasse.
- 2 The Perpendicular Glasse.

The Perpendiculars are either single, double, or treble.

The single Perpendiculars are of two sorts, either fixt or moveable:

The fixt are of contrary qualities ; either such whose included water doth move upward with cold, and downward with heat, or else upward with heat, and downward with cold.

In the double and treble Perpendiculars, as the water ascendereth in one, it descendeth as much or more in the other.

In the moveable Perpendicular the Glass being artificially hanged, it moveth up and down with the water.

How to make the Water.

I must confess, that any water which is not subject unto putrifaction, or freezing, would serve the turn, but Art hath taught to make such a water as may be both an Ornament to the work, and delectable to the eye.

Take two ounces of Verdigrease in powder, and infuse it so long in a pynt of white Wine vineger, untill it hath a very green colour, and then pour out the vineger gently from the Vardigrease : take also a pynt and a halfe of purified May-deu, and put therein 6 ounces of Roman Vitreoll in groz pouder, let it stand till the Vitreoll be throughly dissolved,

dissolved; then mix this with the former water, and strayn them thorow a cap-paper, and put it into a clean Glasse well stopped, and tis ready for use,

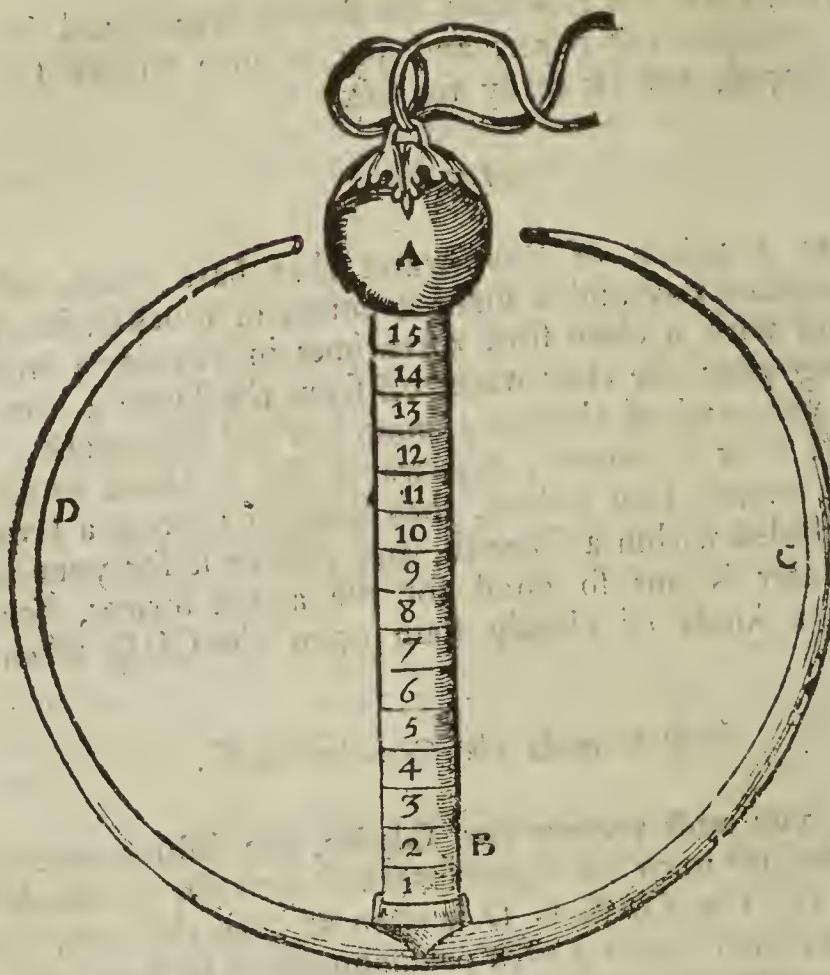
Another

Take a gallon of Rayn-water that hath settled, infuse therein a day and a nighr 4 pound of quick Lyme; stir it about with a clean stick oftentimes in the day; in the morning pour the cleer water off from the Lyme; into a brasse pan, and ad thereto 3 pound of Sal armoniack; let it stand 5 or 6 houres; afterwards stir it about untill it be of a perfect bleu colour, then strain it thorow a brown paper rouled within a Tunnell, and reserve it for your use. This water is not so good for use as the former, for it leaveth a kinde of cloudy stain upon the Glasse when it falleth.

How to make the Circular Glasse.

First, you must prepare two Glasses, the fashion whereof let be like unto the figures marked with the letters A B and C D. The Glasse C D is open at both the ends, also in the middle there is a neck comming up of sufficient wideness to receive the shank end of the Glasse marked with the letters A B. Then fill the Glasse C D a third part, with either of the waters, and divide the Glasse into so many equall parts as you would have degrees; rarifie the Ayer in the head of the Glasse A B by holding it to the fier, which being yet warm, reverse the shank of it into the neck of the Glasse C D. Note that if the water doe not ascend high enough, you must take the Glasse A B out again, and heat it hotter: if it ascend too high, heat it not so hot. If it bee in the Dog dayes, and extream heat of Summer, 1 and 2 are good Degrees; if the weather be most temperat, then 3 and 4 are best; if a frost, 9 or 10. When you have hit an indifferent Degree, lute the joynts very close, and fasten a Ribben unto the top of the Glasse to hang it by.

WATER-WORKS.



In this Glasse the water will with cold ascend the Glasse A B, but with heat it will descend the Glasse A B, and ascend the hornes of the Glasse C D.

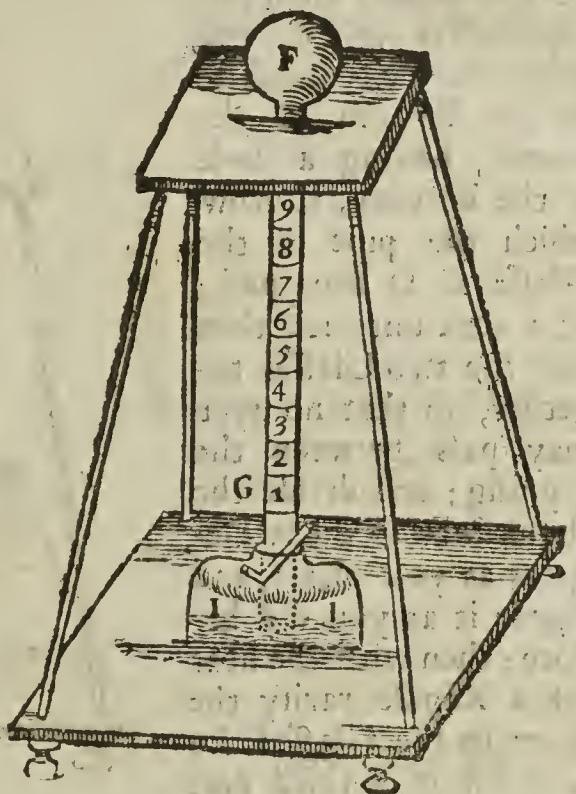
How to make the single perpendicular Glasse, whose water ascendeth with cold, and descendeth with heat.

Prepare two Glasses after the fashion of the figures F G I I. Alwayes chuse those upper Glasses that have the least heads, else they will draw the water too fast, and press it too low; also let not the shank of the Glasse bee too wide: it is no matter to bee curious in chusing the lower Glasse. Having provided both these Glasses, make a Frame for

WATER-WORKS.

35

for them about one inch longer than the shank of the Glasse F G having a hole at the top to put the same thow. There ought to be a great deal of care had in making the Irame so, that the foot thereof may be of a greater compasse than the top, to the end that it may stand firm, and not be subject to bee turned down, which will distemper the whole work. After you have provided the Fraime, proceed to the making of it after this manner : Put both the Glasses into the Frame, and then divide the shank of the Glasse F G into so many equall parts as you would have Degrees ; write figures upon paper, and paste them on, with gumme tragagant dissolved in fayr water ; then fill the bottom Glasse two thirds with the water, and rarify the ayer in the Glasse F G so oft untill you have hit such a Degree as is most fitting for the temper of the weather : put in a little crooked hollow cane for the ayer to passe in and out at, but let it not touch the water : then stop it about the joynts of the Glasse with good cement, that nothing may come out. Make an artificiall Rock about it, with pieces of cork dipt in gleu, and rouled in this following pouder, and it is done.

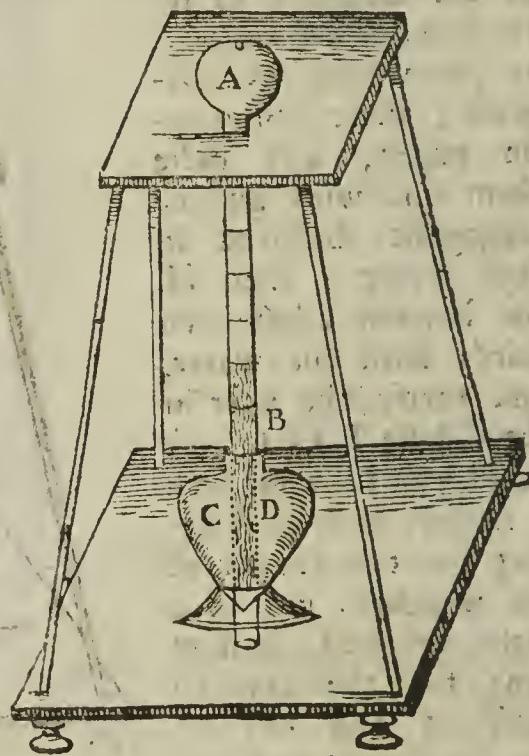


The pouder for the Rock.

Take mother of Pearl 2 Pound, small red Corall halfe a pound, Antimony crude 4 ounces, and make a grosse pouder of them.

To make the single perpendicular Glasse, ascending with heat, and descending with cold.

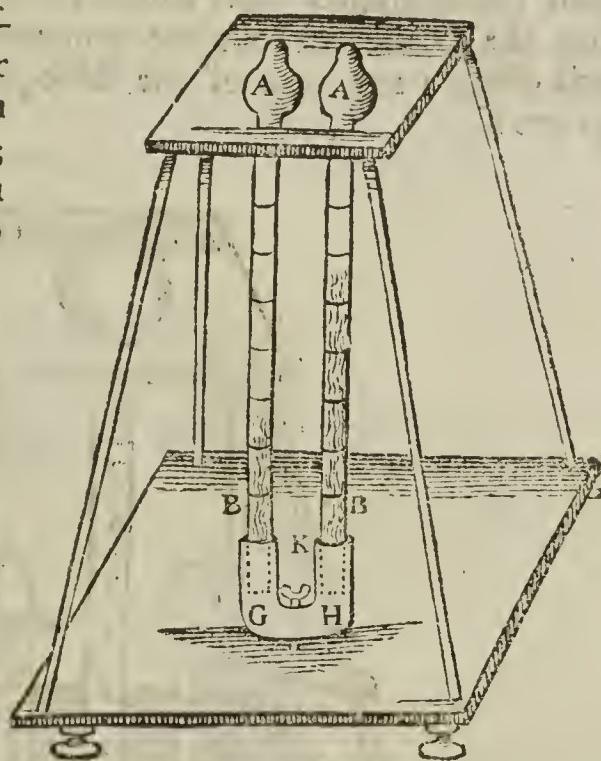
PREpare two Glasses after the fashion of the figures A B, and C D: let the Glasse A B have a small pinhole in or about the top of it, and let the Glasse C D have besides the hole at the top, another hole at the bottom, with a short pipe. Provide such a Frame for this as you did before for the other; then put the Glasses into it, and fasten the bottom Glasse to the bottom of the Frame, having a hole at the bottom, thorow which the pipe of the Glasse C D may pass; fit a cork unto it: then lute the two Glasses together, so that no ayer may pass between the joyning; and divide the shank into so many Degrees as you please, and figrue it as you did before; then with the heat of a Kandle rarify the ayer in the Glasse C D, and fill it a third part full with water, and then put the cork fast in: Note that if the first heating of the Glasse rayse not the water unto your content, you must repeat it over and over, untill it do: when it is sufficient, then stop the cork in very firm, that no water may come out, and tis made.



How to make the double perpendicular Glasse.

PREpare two Glasses like unto the figure marked with the letters A B, the one of them must have a small hole in or

or about the head thereof. Prepare likewise for the bottom a Vessell of the fashion of the figure G H, having two mouths, at each end one; also a cock in the middle, as K: then divide the shank of the Glasse without the hole in the top, into equall parts, and set numbers upon it; and then lute them both fast into the necks of the bottom vessell: But first remember to put them in a Frame. When the cement is dry, turn the cock of the bottom vessel, and rarify the ayer in the Glass that hath no hole at the top; then set the bottom vessel a little way into a vessel filled with water, and it will suck up the water as it cooleth; when the bottom vessel is full, and the water mounted in the Glasse that hath no vent at the top, up to a fitting Degree (the temper of the weather regarded) then deppresse (but gently) the Glasses into the vessel of water untill

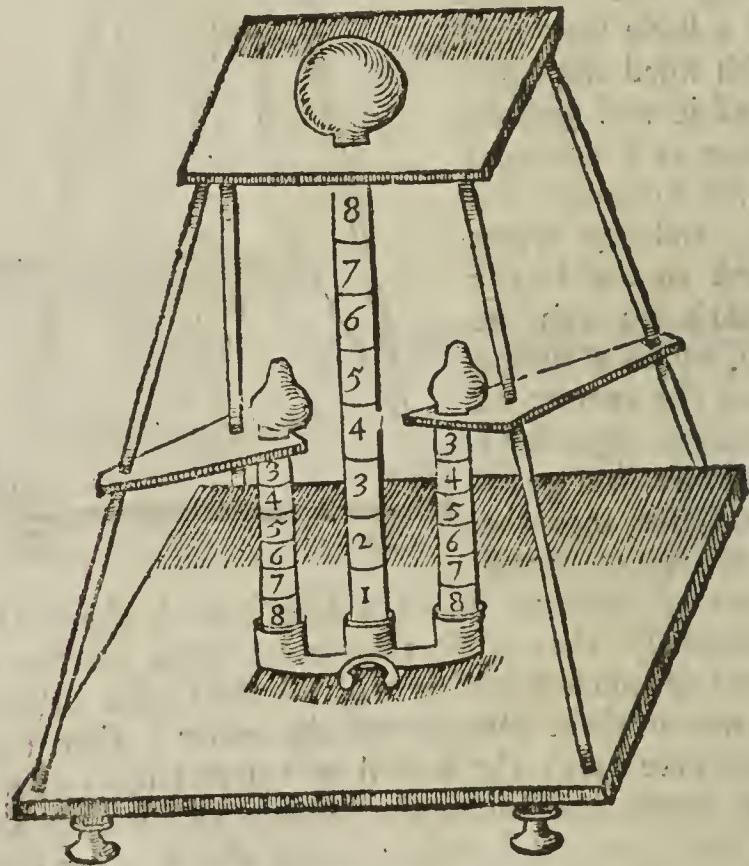


the water be come up into the Glasse with the vent at the top sufficiently, that is, so that in both the Glasses may be contained so much water as will fill the shank of one, and about two or three Degrees of the other; then turn the cock, and take away the vessel of water from under them, let them down, and fasten the bottom vessel unto the bottom of the Frame, and make a Rock about it, or else what other works you please, that the Art may not be discerned: lastly, set figures upon both, but first upon that without the vent, beginning from the bottom, and proceeding upwards, then lay your hand upon the head of it, which will deppresse the water, which when it commeth equall to the

Degrees, paste the same Degree on the place of the water in the other Glasse with the vent, and tis done.

How to make the treble Perpendicular Glasse.

After the same manner is the treble Penpendicular Glass made: but whereas in the double Glasse there was but one Glasse that had a vent at the top, there is two in this, both whose shanks must contain the just quantity of water that the Glasse without the vent will contain. If you doe well observe the form of the subsequent figure, you cannot go amisse.



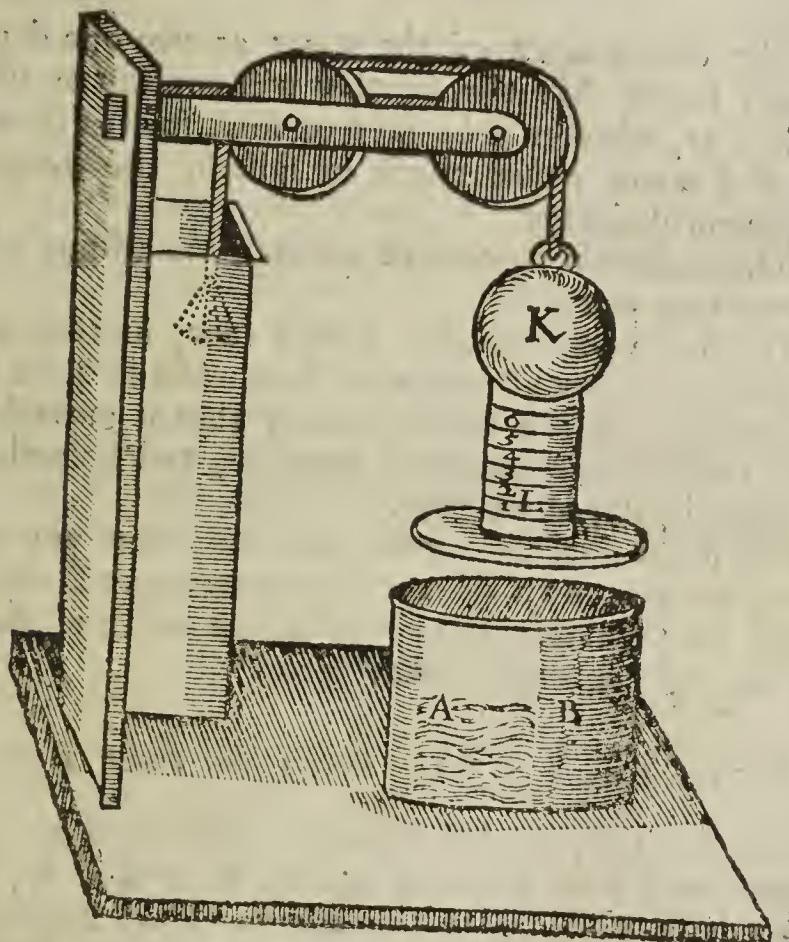
How to make the moveable Perpendicular Glasse.

First prepare the Glass A B, fill it almost top full of water, provide also the Glass K L, having a loop at the top

WATER-WORKS.

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top of it : divide it into so many equall parts as you would have Degrees, and on the mouth thereof fasten a thin boord that will easily slip in and out of the bottom Glass: make then a waight of Lead or Brass somewhat heavier than both the Glass and boord fastened thereto, and then tie a little Rope to the loop of the Glasse A B, and the waight at the other end thereof. Rarify the Ayet contained iu the Glass L, and reverse it into the Glass A B filled with water, and hang the plummet or waight over two little pulleys fastened in a Frame made for the purpose, and as the Glass K L kooleth, the water will ascend the same, and so by the change of the weather, both the Glass and the water will move accordingly.



Of the use of all the severall sorts of weather Glasses.

Albeit the forms of weather Glasses are divers, according to the fancy of the Artist, yet the use of all is one and the same : to wit, to demonstrate the state, and temper of the season, whether hot or cold ; as also to foreshew the change and alteration thereof.

1 Note therefore, that the nature and property of the water in all the Glasses that have no vent holes at the top, is, to ascend with cold, and descend with heat. But in them that have vents, it descendeth as much as it ascendeth in these.

2 The sudden falling of the water is an evident token of Rayn.

3 The continuance of the water at any one degree, is a certain token that the weather will continu at that stay it is then at, whether it be fayr or foul, frost or snow. But when the water either riseth or falleth, the weather will then presently change.

4 The uncertain motion of the water is a signe of fickle, and uncertain weather.

5 The single perpendicular with a vent, moveth upwards with cold, and downwards with heat, and is quite contrary in quality to the former, onely that it moveth uncertainly in fickle and uncertain weather, and keepeth a constant place in stayed weather.

These Rules are all certain and tru : now you may according to your own observacion frame other Rules, whereby you may foretell the change of the weether, the water being at any one degree whatsoever.

A Water-Clock, or a Glasse shewing the houre of the Day.

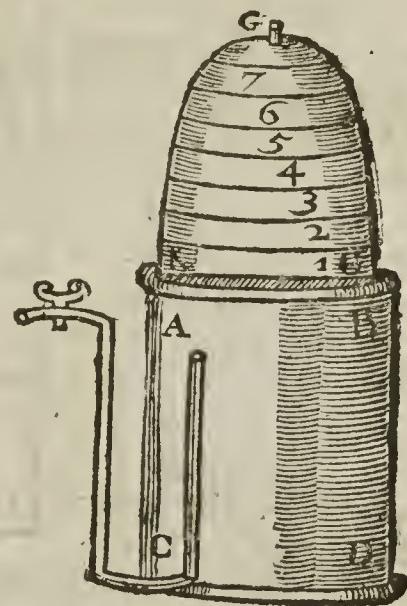
Let there be provided a deep vessell of earth, or any thing else that will hold water, as A B C D, provide also a Glasse made after the fashion of the figure marked with the letters K G G. It must bee open at the bottom, and have also a small hole at the top, thorow which if you can

can but put the point of a needle, it is sufficient: this Glasse must not be so long as the vessell is deep, by about two inches. Then take a just measure of the length of the Glasse K G G and set it on the inside of the vessell A B C D from the bottom towards the top, and then make a rase round about the vessell; there must be fitted unto this earthen vessell, a pipe reaching from the top of the outside thereof, (where there must bee a cock unto it) and going unto the bottom, where it entreth the same, and again extendeth it selfe almost unto the circle or mark rased on the vessell A B C D. Fill then the vessell with fayr water up to the rase or circle, and turn the cock, and put the Glasse into the water, and you shall see that the Glasse by reason of its heaviness, will tend toward the bottom of the vessell, but very slowly, by reason that the Ayer contained therein hath so small a vent: turn an Hour Glasse, and at the end of each Hour make a mark upon the Glasse equal with the water, and it is done. When the Glasse is quite sunk to the bottom of the water, turn the cock, and with one blast of your mouth at the pipe, it will ascend again.

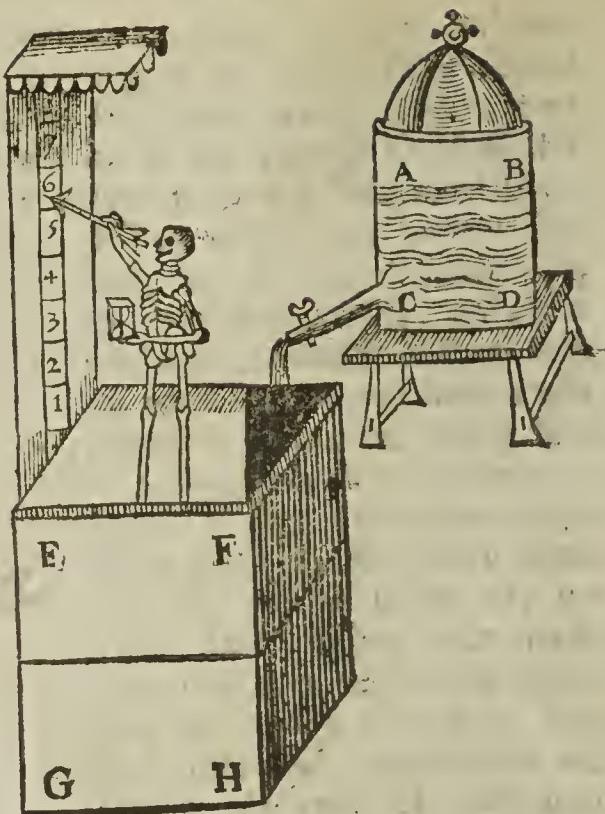
Another fashioned one

P Repare a vessell, as A B C D having a very small cock unto it, whose passage ought to be so small, as that the water might issue out but by drops: Prepare likewise a vessell, as E F G H having at one end of it a pillar of a foot and a halfe, or two foot high: let there be fitted unto this vessell a boord, so that it may freely without stay, slip up and down: towards one side of this boord,

G
there



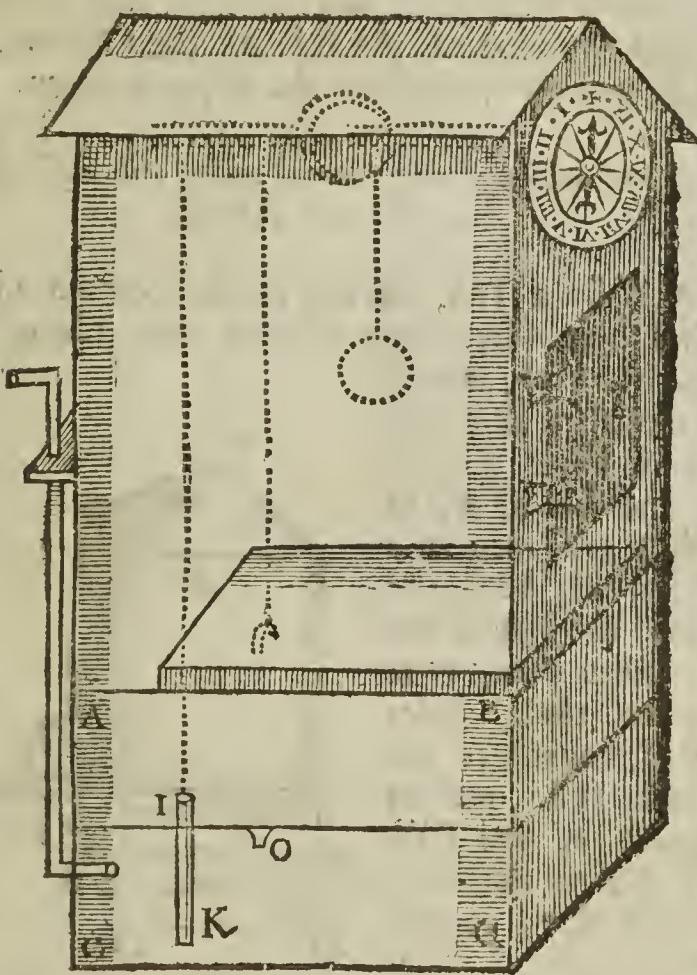
there must be a good big hole, which must bee placed under the cock of the other vessel. Then fasten unto the top of this boord, the Image of *Time* or *Death*, and pointing with a Dart upon the piller aforesaid : turn then an *Houre-Glasse*, and at the end of every *Houre*, make a figure on the place of the piller that the Image with his Dart pointeth at, and it is made. For note, the dropping of the water out of the cock thorough the hole of the boord whereon the Image standeth causeth the same to ascend by little and little. Mark the figures.



Another artificiall Water-Clock, which may be set conveniently in a double Weather Glasse.

First prepare a Cestern, as A B C D having a partition F in the middle, let there be made two pipes, the one whereof must reach out of the upper Cestern and descend almost to the bottom of the lowest Cestern, as I K ; the other must be a short one, and have a very small hole, that the water may thereby issue out of the upper Cestern but by drops ; also at the side nigh the bottom of the upper Cestern, let a small pipe enter. To the upper Cestern fit a boord, (with a peece of lead nailed upon it to make it somewhat heavie) so that it may easily slip up and down in it ; this boord must have a loop to fasten a rope unto, and you must so poysse the sayd boord, that it being hung

hung up by a line, may hang yeven and levell. Then prepare a Box to put over the Cestern, which ought to stand about 6 inches above the Cestern : in the top of this Box let there be fastened a long Fulley with a crevice to put a small rope over : in this crevice it were fitting to fasten smal pins, to the end that the rope may turn the said wheel as

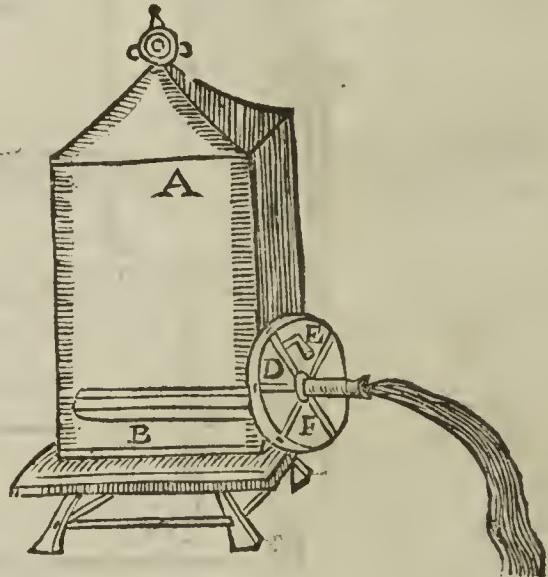


the water falleth from under the boord : let the Spindle of this pulley come out at one side of the Box whereon there is a Dyal drawn, containing so many houres as you would have it go for : unto this end of the Spindle let there bee fitted a Needle or Director for to shew the hour ; then put a small cord over the pulley in the Box, and fasten one end thereof unto the loop of the boord,

and at the other end let there bee tyed a waight not quite so heavy as the boord ; then fill the upper Cestern with water, and the boord will presse it out into the lower vessell, at the pipe O, drop by drop ; and as the boord sinketh lower, it will by means of the rope upon the pulley, turn the Index or Director fastened unto the Spindle of the pulley about the Dyall ; you may set it by an Hour-glassē or Watch : when it is quite down, if you doe blow with your mouth into the pipe at the side of the Cestern, the water will all mount up again into the upper Cestern.

A Wheel which being turned about, it casteth water out at the Spindle.

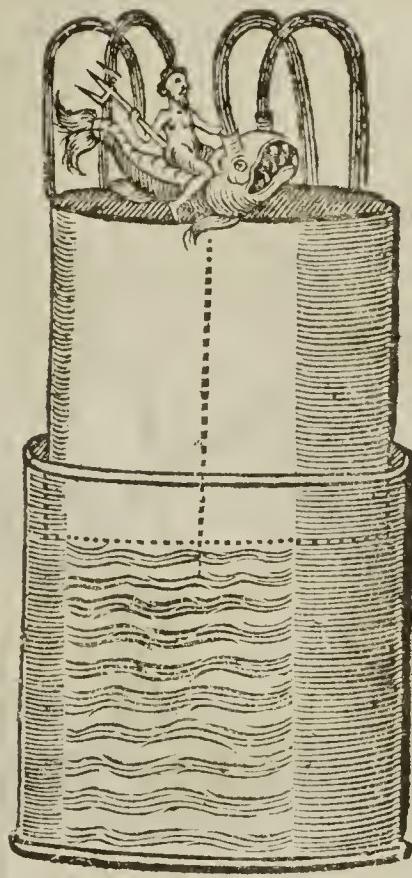
LET A B be a Tub, having in the bottom a brass Barrell with a hole quite open thorow one side of it : let D E F, bee a wheel, whose Spindle must bee also hollow, and have a hole thorow one side of it, so that being put into the hollow Barrell, both the holes may be equall together. Note then, that so long as these holes are equall, together, the water will run out at the Spindle of the Tub; but if you turn the wheel to another side, it will not run.



A Water-Presser, or the mounting of water by compression.

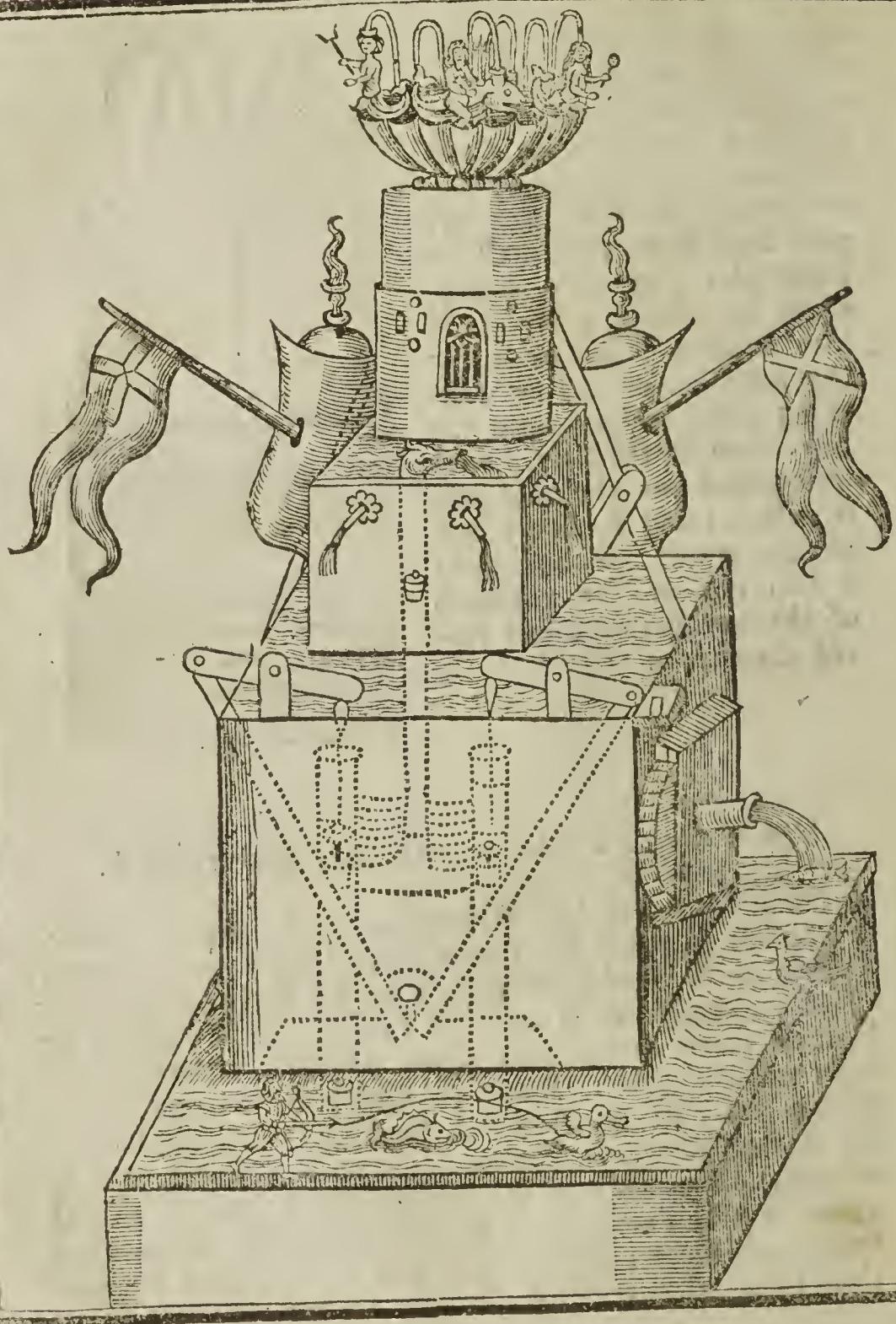
LET there be provided a Barrell of brass, of what length and widenesse you please, let it be exactly smooth within, and very tight at bottom : unto this Barrell fit a plug of wood leathered about, and let there bee made divers small

small holes quite thorow it, wherein fasten divers formes and shapes of Birds, Beasts, or Fishes, having very small pin-holes thorow them, for the water to spin out at: you shall doo very well to make this plug very heavy, either by pouring melted Lead into certayn holes made for the purpose, or else by fastening some waight unto the top: then fill the Barrell with water, and put the plug into it, which lying so heavy upon the water; it will make it spin out at the pin-holes of the immages or forms placed thereupon.

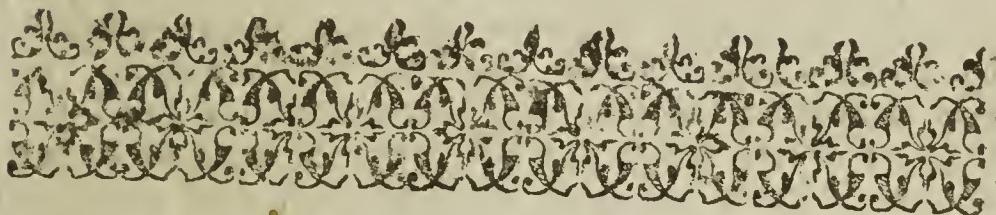


How to compose a great or little peece of Water-work.

First prepare a Table, whereupon erect a strong Frame, and round about the Frame make a Moat with a leaden Cestern to be filled with water; let the leaden Moat somewhat undermine as it were the Frame, which ought to be built in three stories, one above another, and every one lesser than another. Within the middle story fasten a very strong jack that goeth with a waight, or a strong Spring, the ending of whose spindles ought to be crooked, thus Z, whereby divers Sweeps for Pumps may be moved to and again, whose Pumps must go down into the Moat, and have small suckers unto them, and conveyances towards their tops, wherat the water may be mounted into divers Cesterns,



Cesterns, out of some wherof there may bee made conveyances in their bottoms, by small pipes running down into the River or Moat again, and there breaking out in the fashions and forms of Dragons, Swans, Whales, Flowers, and such like pretty Conceits: out of others the water may fall upon wheels, out of whose Spindles the water turning round, may be made to run. In the uppermost story of all let there bee made the Forcer by Ayer, as I taught before or else a Presser, having at the top, *Neptune* riding on a Whale, out of whose nostrils, as also out of *Neptune's* Trident, the water may bee made to spin thorow small pin-holes: you may also make divers Mocions about this work, but for that the multitude of Figures would rather confound than instruct the Reader, I have of purpose omitted them.



An Appendix unto the WATER-WORKS.

CHAP. I.

 Ou may remember I have tould you formerly, that water (one of the foure Elements) is a massie subtile substance; now every heavy thing wee know tendeth naturally downward, so that if it had a passage unto the middle or center of the Earth, thither it would run, there it would abide. I tould you likewise, the use of the Crane pipe, which is called by some

some, the Philosophers Engine, whereby water may bee conveyed from a Fountain, notwithstanding the interposition of Hills and Mountaines : this considered, that the place unto which you would convey the water, lie somewhat lower than the Fountain, which may easily be essayed by divers instruments, principally the Geometricall Square : so the place may be viewed from the Fountain, or both the place and the Fountain may be viewed from any Tower, Church, or Hill, that is betwixt both. The description and use of which instrument, since it is both easie and common, it will be needlesse for me to describe.

This is the naturall course of water, but there is a second kinde of conveyance of water, which we call artificiall, whereby by Engins artificially contrived we either draw or force up water, to some higher place or places to be thence conveyed unto any place desired. These Engines receive their mocion divers wayes. First, by the stream of the same River, wherein they are placed. Secondly, by the Winde. Thirdly, by Horses. Fourthly, by a Crane-mill: and lastly, by divers Pumps, Forces, and such like Invencions. You may remember likewise, that I have formerly tould you, that no water work can bee composed without Suckers, Forcers, Clacks, either or every of them. And now I will not insist upon what I have formerly spoken, but referre you for that unto the former part, pa. 13, and proceed to the descripcion of some things of more service & difficult composition. First, I will describe other Clacks, and Suckers, teach their divers applicacion ; and then I will describe certain Mills and Engines. First, for mounting of water to be conveyed to remote places, for divers uses : secondly for dreyning of Medowes : thirdly, for quenching of fier in Buildings : and lastly, for Recreacion and Delight.

C H A P. 2.

BY the letter A is signified a Sucker, made after the usuall manner, saving that it hath an edge round about the bottom of it : which edge or brim hath divers little holes in it, wherby to nayl it upon any part, where need requireth.

B

B signifieth a peece of Timber made square, and perforated to nayl the Sucker upon.

C signifieth a Grate to be nayled upon the bottom of the said peece of Timber, noted with the letter B. The use of this Crate is to keep grayell, strawes, and durt from ascending with the water.

D demonstrateth another sort of Sucker, which according unto the Stresse of the work unto which it is to bee applyed, may bee made either of brasse or wood ; the Invention I conceive to bee very commodious, and for use most excellent, especially in greater works, and that for this cause, that upon all occasions of disorder or mischance, it may with ease bee opened and shut without any farther trouble unto the work. D I say signifieth a Box made foure square, and of a convenient bignesse according unto the widnesse of the bore of the Barrell whereunto it is to be annexed ; indeed it ought to be cast with the Barrell. Upon two sides of it, must be two small eminences with holes thorow them, whereby to pin the cover on fast ; there must be a hole thorow one side of it, to give the water passage into the Barrell : a second hole there must bee on the other side, to send the water up the main pipe : a third hole there must be in this Box at the bottom, to give the water admittance into the work, by meanes of a Clack or Pallet, that is fastned upon it. Now the bottom of this Box must be made reclining wise, that is, higher on the one side than on the other.

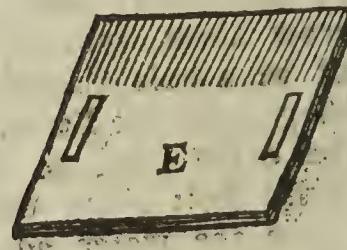
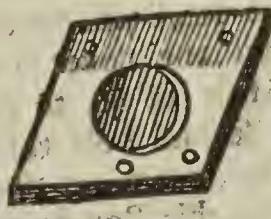
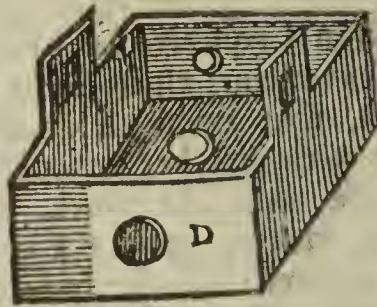
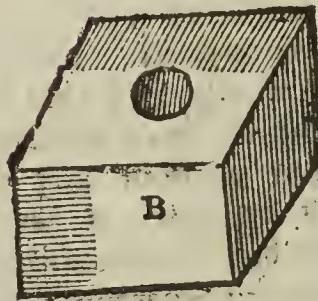
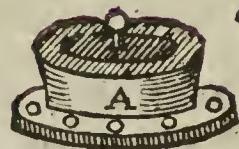
E signifieth the Lid which hath two holes, to put over the two eminences on the sides of the Box, and pinned close down. Note that you must put good liquered leather doubled betwixt the Box and the Lid, which serveth to keep it tight.

F signifieth a Barrell of brasse, made to skrew on any part with one end.

G signifieth a Clack or Pallet to be fastned upon the inside of the Cover H.

H

H signi-

Figura 1.

H signifieth a Cover that is to be soldered upon the other end; this Cover must have a hole bored in it, to give the water ingresse into the work.

I signifieth another Sucker or rather Pallet, and it is a Box made of brasse, having a bottom with a hole in it, and over it must be riveted a pallet or Clack; the bottom of this Box must bee made higher on the one side then on the other, so that beeing nayled to any perpendicular or erect standing Barrell, it may encline somewhat as may appear by the figure.

The applicacion of these Clacks and Suckers, is so to bee contrived as they may suit with the convenience for the work; somtimes at the sides of the Barrells, somtimes at the bottoms: in like manner Forcers may be made to move either horizontally or perpendicularly, according unto the convenience of the work, or the invencion of the Artist and Engineer.

C H A P. 3.

*The Descripcion of the Engin near the North
end of London Bridge.*

Divers Rivers there are, which according unto their propinquity or remotenesse from their mother Sea, run and return (I mean ebbe and flow) more or lesse; whose force and stream in some is of its own accord, sufficient to mount its proper water, as may be seen at the Water-Mill or Engin near the North end of Lunden Bride; which Engin by the Ebbing and Flouing of the Thames, doth mount the sayd water unto the top of a Turret, and by that means it is conveyed above two miles in compass, for the use and service of that City. Which Engin I circumspectly viewed as I accidentally passed by, immediatly after the late Fire that was upon the Bridge Anno 1633. and the Device seeming very good, when I came home I drew a Modell thereof, and have here presented it unto thy veiu.

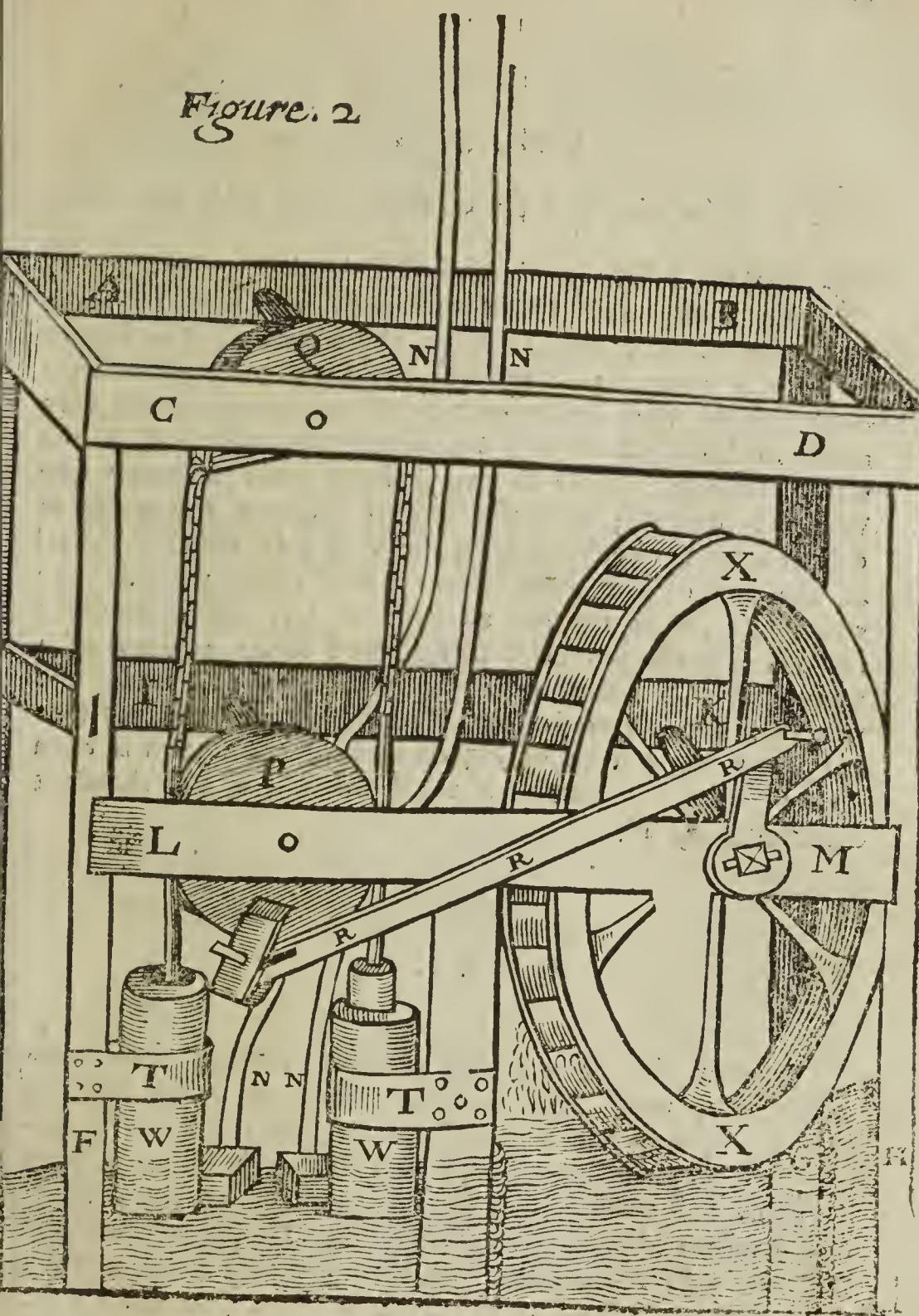
WATER-WORKS.

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A B C D E F G H I K L M, doe signify a Frame, strongly made of Timber, X X signifie the water wheele, the Gudgins of this wheele must be set to turn in strong brasse Sockets, firmly set in the two middle-beames of the Frame I K L M. The ends of the said Gudgins, must bee made to reach a good way over the Beames, and they must be made square towards their ends, and have each a handle pinned fast on. Then in the middle Beames I K L M, must likewise be fastened another strong wheele, as P, which must have as it were a spoak, reaching out from it, upon the lower side. There must also be another halfe or 3 quarter wheele, as Q placed directly above it, whose diameters must be of one size or proporcion : directly under the utmost edges of these wheeles must be firmly set two strong Barrells of brasse or yron, which is of more duranc as W W, having each of them a Sucker cast with the Barrels : These Barrels must be bound fast unto two posts of the Frame, with two strong yron bands, as T T, to the end they may not stirr : unto each of these must be fitted a Force well leathered, and in the tops of the Forces must be set two peices of wood, two foot long, and about two inches thick, and to the tops of them must be linked two chains of yron : which must be linked straight up to the two ends of an yron band, that must compasse the circumference of the uppermost wheele noted Q : a long and strong wooden bar must come over the handle of the mayn wheele, and upon the spoak of the wheele P, this barre is noted with R R R. N N N N signifie the Pipes wherinto the water is forced. These Pipes carry the water to the top of a Turret near adjoyning unto the Engin, and there being strayned, thorow a close wyer grate, it descendeth into the mayn wooden pipe, which is laid along the streets, and into it are grafted divers smaller pipes of Lead, serving each of them to the use and service of particular persons.

CHAP. 4

Figure. 2



C H A P. 4.

The Description of a second Engin for a Tyde water.

This Mill I have partly described in the former Part of this Book; and therefore I shall not need to make repetition of that which I have there spoken. The Figure it selfe is plain, and needeth little or no explikacion: nevertheless, that I may give every one content, take thus much in brie. A A B B signifyeth the frame; C C the water Wheele; D D D two hollow posts whereup the Water is driven; E E the cestern wherein the water is driven up. F one Wheele in the Wel; G another Wheele at the top of the posts. The Water turning about the wheel C C, that turneth the wheele I I, the wheele I I turneth the wheeles G K and F, and so by meanes of a Chayn that is linked over the wheele G and under the wheele F the water in the Well by certain Leathers that are upon every sixth or eighth Link of the Chayn is born up one of the Barrels into the Cestern E F and thence it descendeth by M,

C H A P. 5.

But now for Rivers that are more remote, there is no sensible, much lesse forcible return or going back of the water, nor are the streames in divers sufficiently violent, to give mocion unto a Mill or Engin; except they be adjuvated and assisted by some ingenuous Devise. In places where Milles are in the Country, there are Ponds or Mill-heads (for so they call them) which contain great store of water; and the same is in some (by sluices) let down

WATER-WORR'S.

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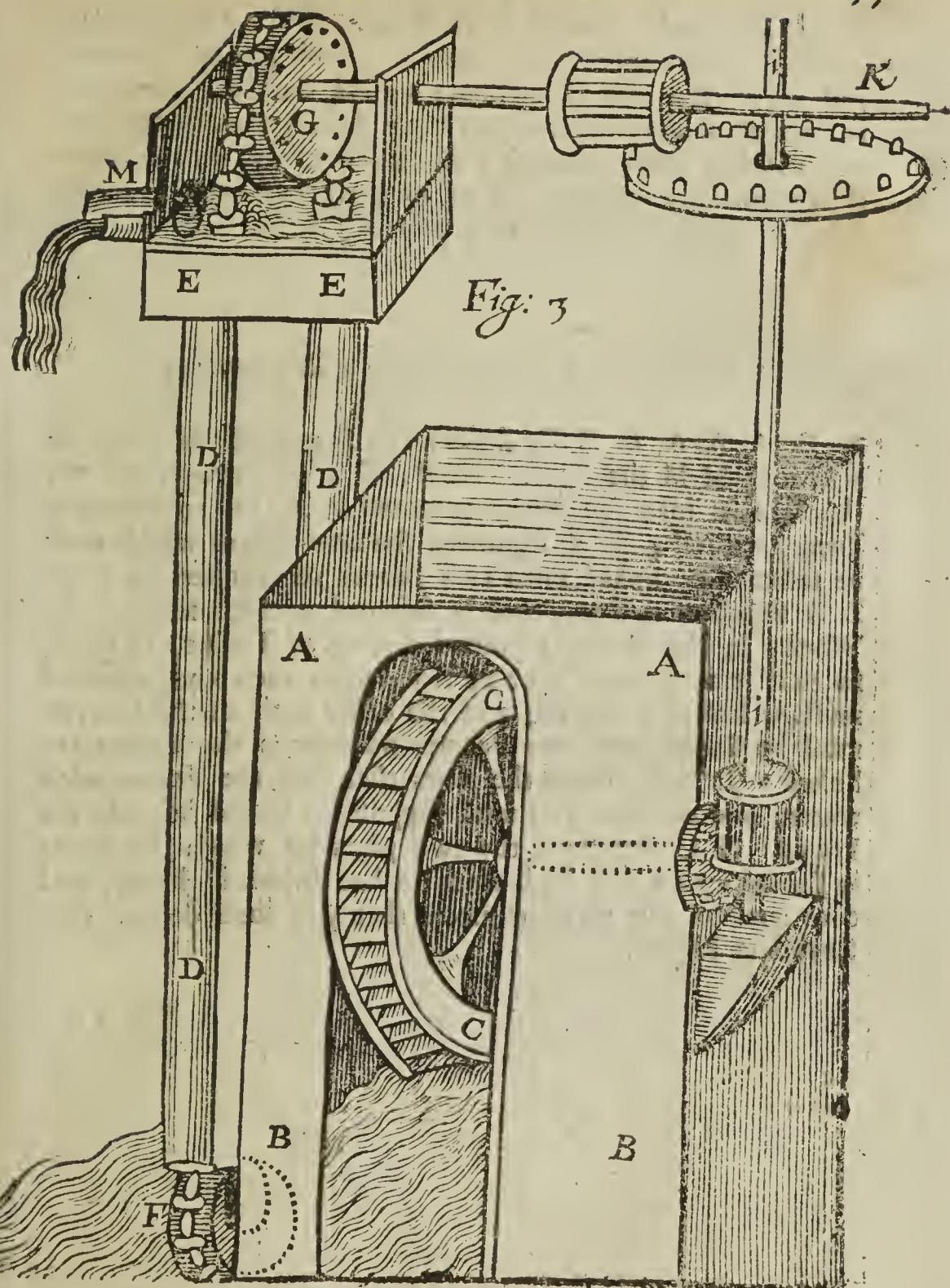


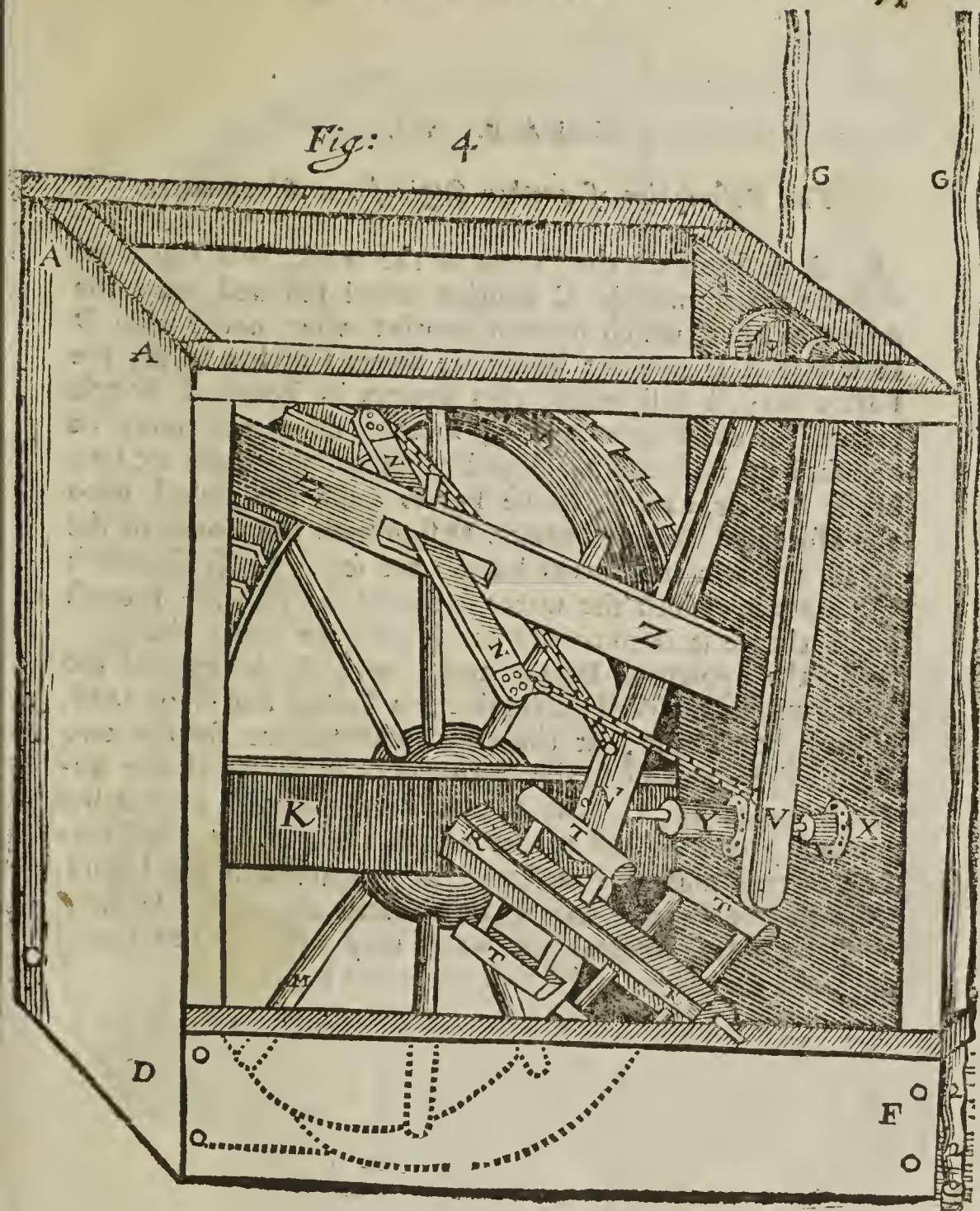
Fig: 3

down shelvingly upon the lower part of the Mill wheeles : in other places where they have not such plenty of water, and where the Mills stand lower a good deal than the heads, the water descending from on high thorou some spout, falleth directly upon the mayn wheel ; whereby a little water thus artificially disposed , is of as great equivalence to the driving about of a Mill, as a greater Stream.

The Descripcion of a Mill for a River Water.

Let A A A, C D E, signify the Frame of the Work or Mill ; M M the water Wheel, T T T certayn Frames that are let into the Axel-tree noted R R, for to move the Forces withall ; X Y signifieth the two Forces which must be fastened or linked unto two Beams of Timber, as V V, Z Z signifieth a Beam that is fastened at each end of the Work ; in this Beam is pinned a piece of Timber, as N N, so that it may move to and fro ; unto each end whereof must be linked a Chayn, and the other ends of the Chayns must be linked unto two Beames whereunto the Forces are linked : J L signifieth the pipes that feed the Forces with water, one whereof you must suppose to be hid behinde the Frame : G G signifieth the two pipes by which the water is forced up to any high place to bee disposed thence, and conveyed to any place or places that you shall desire. Observe the Figure.

Fig: 4



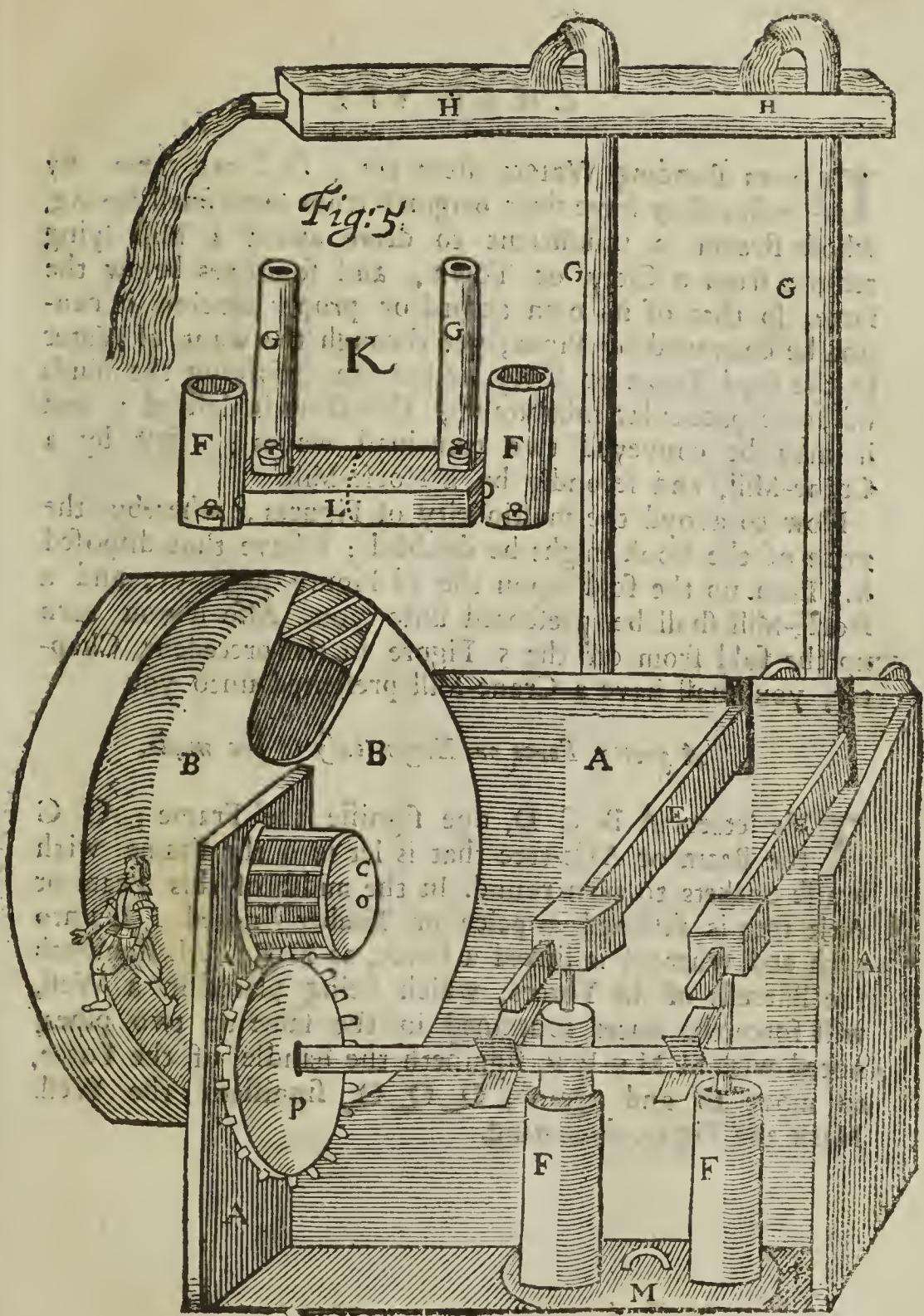
WATER-WORKS.

C H A P. VI.

The Descripcion of another Engin for a River water.

A A A signifieth the Frame of the work, B B signifieth the water wheel, C another wheel fastened unto the Axle-tree of it, which moveth another wheel noted with D in whose Axle-tree are firmly set divers Catches to lift the Forces up; E E signifieth two Beames in Form of Beetels joyned in the Frame A A A, so that they may move or be lifted up and down. Directly under these, are set two brasse Barrels, as F F, whose Forces must bee linked unto the aforesayd Beetels beames. M signifieth the Cover of the Well, wherein the Forces Barrels are set: G G signifieth the Pipes by which the water is forced up into the Trough H H, thence it is conveyed at N, to some lower places.

By the uppermost Figure noted with K, is signified the Work within the Well: L signifieth a hollow Barrell of Lead, Wood, or Brasse, at the ends whereof are set the two Forces F F: and G G signifieth the pipes by which the wa-
ter is forced up: in the middest of the Barrell L must bee made a particion, and at the bottoms of the Pipes and For-
cers Barrels must bee Suckers, as appeareth in the Figure.
Also in the Forcers Barrels immediatly above the Suckers,
must be holes, wherat the water may passe, or bee forced
into the Barrell L, and so up the pipes F F.



CHAP. VII.

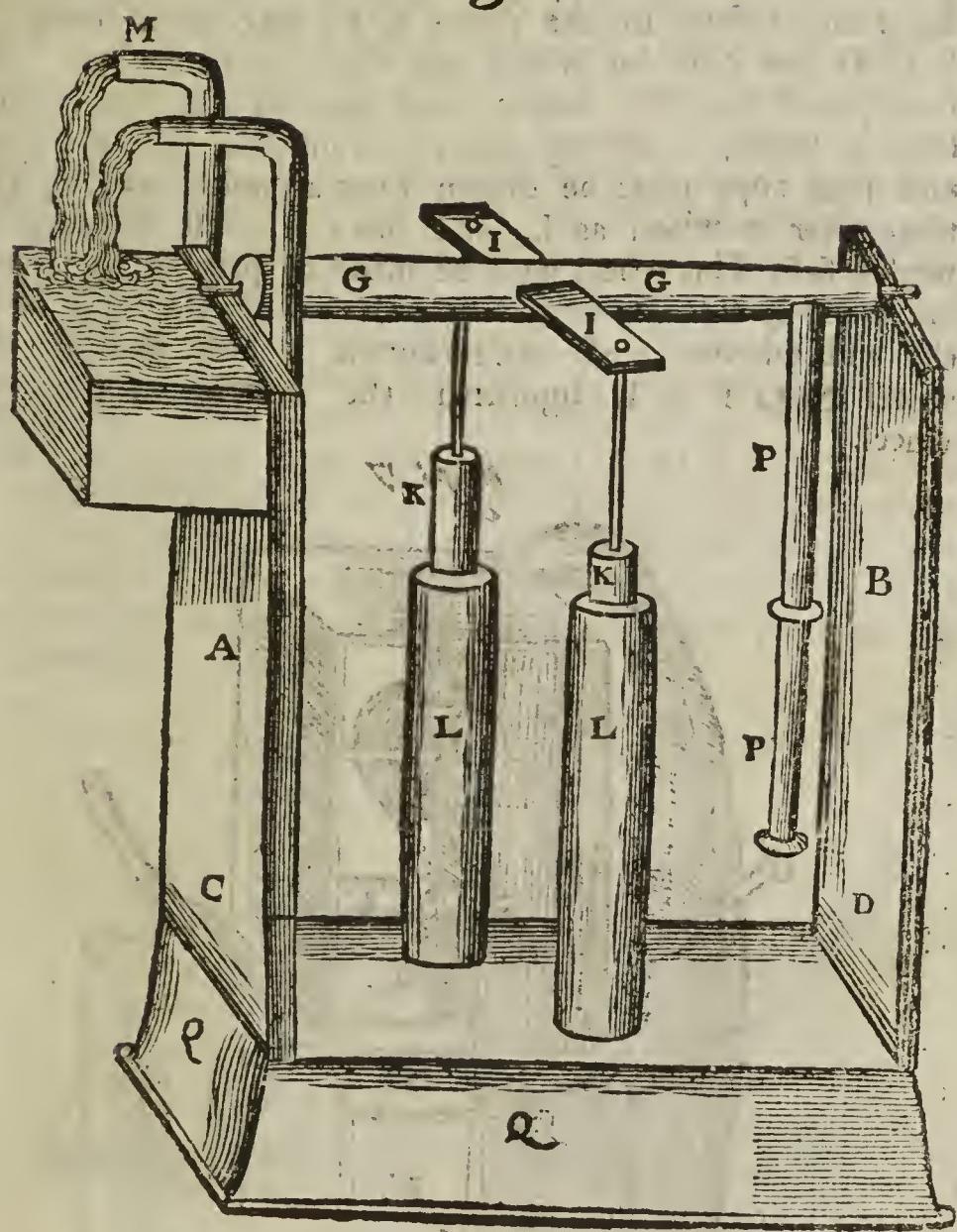
Divers standing Waters there are ; so I call them , by reason they have their originall from some small Spring whose stream is insufficient to drive about a Mill lying remote from a Citty or Town , and somtimes below the same , so that of its own accord or proper mocion it can not be conveyed by Pipes ; yet through the want of Water in the sayd Town or Citty , or for the satisfying the minds of some particular inhabitants , this same is desired : and it may be conveyed two principall wayes ; first by a Crane-Mill , and secondly by a Horse-Mill .

Now to avoyd the multiplicity of Figures , whereby the price of the Book might be doubled ; I have thus disposed it . Turn up the fold upon the 3d Figure page 55 , and a Horse-Mill shall be presented unto you . Also if you turn up the fold from off the 5 Figure in the precedent Chapter , you shall have a Crane-Mill presented unto you .

A pretty Force or Engin easy to bee made.

THe letters A B C D , doe signifie the Frame ; G G the Beam or Axle-tree that is let into the Frame with brasse Sockets to turn round . In the midst of this Beam or Axle-tree is fastened a peice of Timber noted I I , unto each end whereof is linked a Force , as K K : L L signifieth the Barrells of the Forces , which being placed in a Well , will force the water contained in the same up two pipes , noted with M M : P P signifieth the handle of the Force , to move to and again ; Q Q Q signifieth the Well . Mark the Figure following .

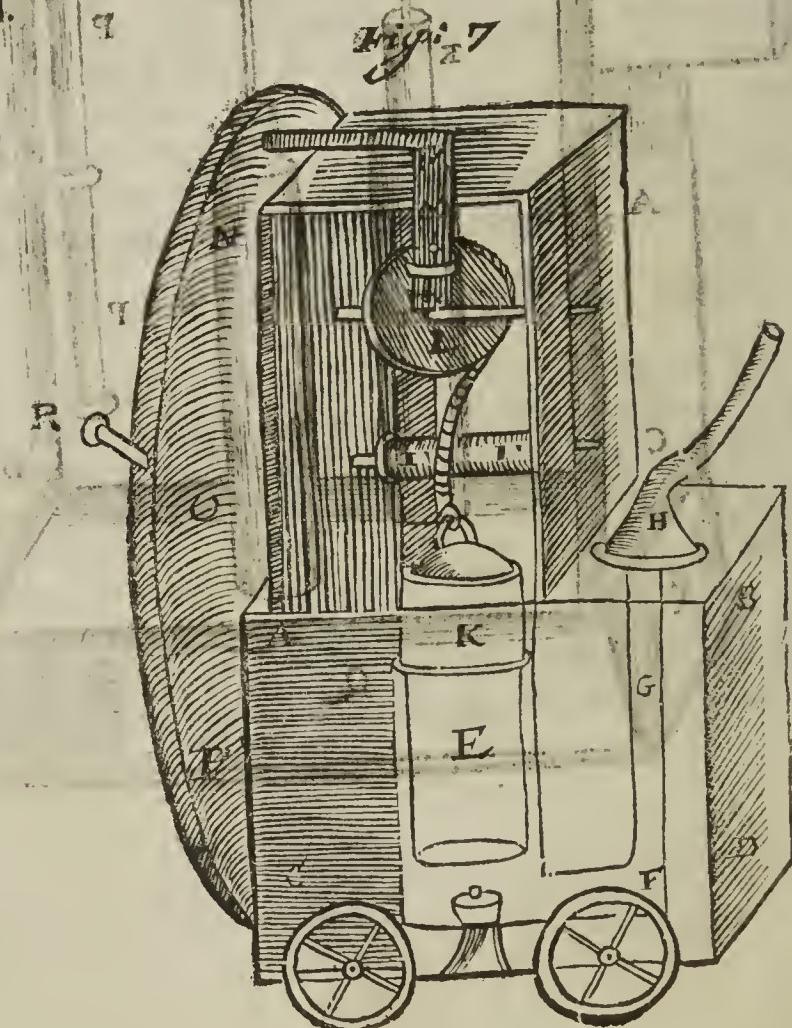
Fig: 6



WATER-WORKS.

Another pretty Force.

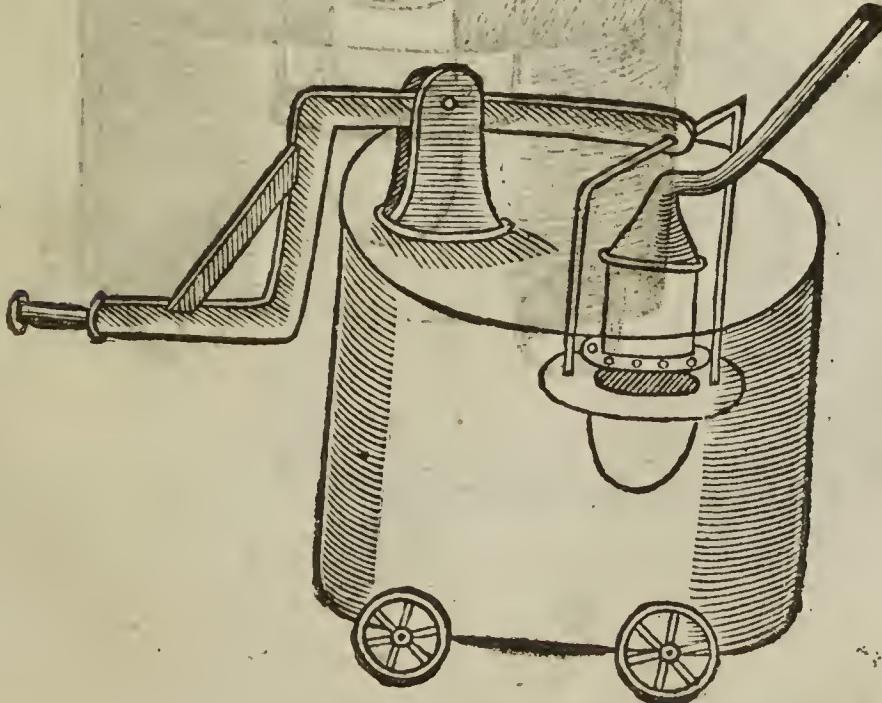
Let A B C D signify a Well, E a barrell of brasse or
wood fastned in the Well; K a Force fitted unto it;
F G H the pipe by which the water is forced up: the
force must be very heavie, and must have a strong yron
loop or staple, in the top whereunto must be fastned a rope,
and that rope must be drawn over a pulley, as I I, and
then over a wheel as L, and there it must be tyed or
nayled fast. This wheel must be made to play in the work,
and unto it must be nayled an yron rod noted with M M
the end whereof must passe thorow a hole made in the
wheel N O P: R signifieth the handle of the sayd
wheel.



C H A P. 8.

HAVING sufficiently spoken concerning Mils and Engins for mounting water for meer conveyance, thence we may derive divers Squirts and petty Engins to be drawn upon wheeles from place to place, for to quench fier among buildings ; the use whereof hath been found very commodious and profitable in Cities and great Townes, this considered, that they have water at hand sufficient to feed them withall : for they doe by their violent casting the water up dead the fier, having new taken hold upon any out side of building. Also, they doe the same if the convenience of the place doe permit so to place the sayd Engins, that the water squirted, may fall directly upon the erpcion of the flame. Their Descripcions follow ; first such as I have seene used, then such as I conceive to bee no lesse usefull than the former. They consist for the most part of Forces. One I have described in the former part ; it remaineth onely, that I inclose it in a Case or Cestern to put the water in, and to be drawn from place to place, as necessity requireth.

Fig:

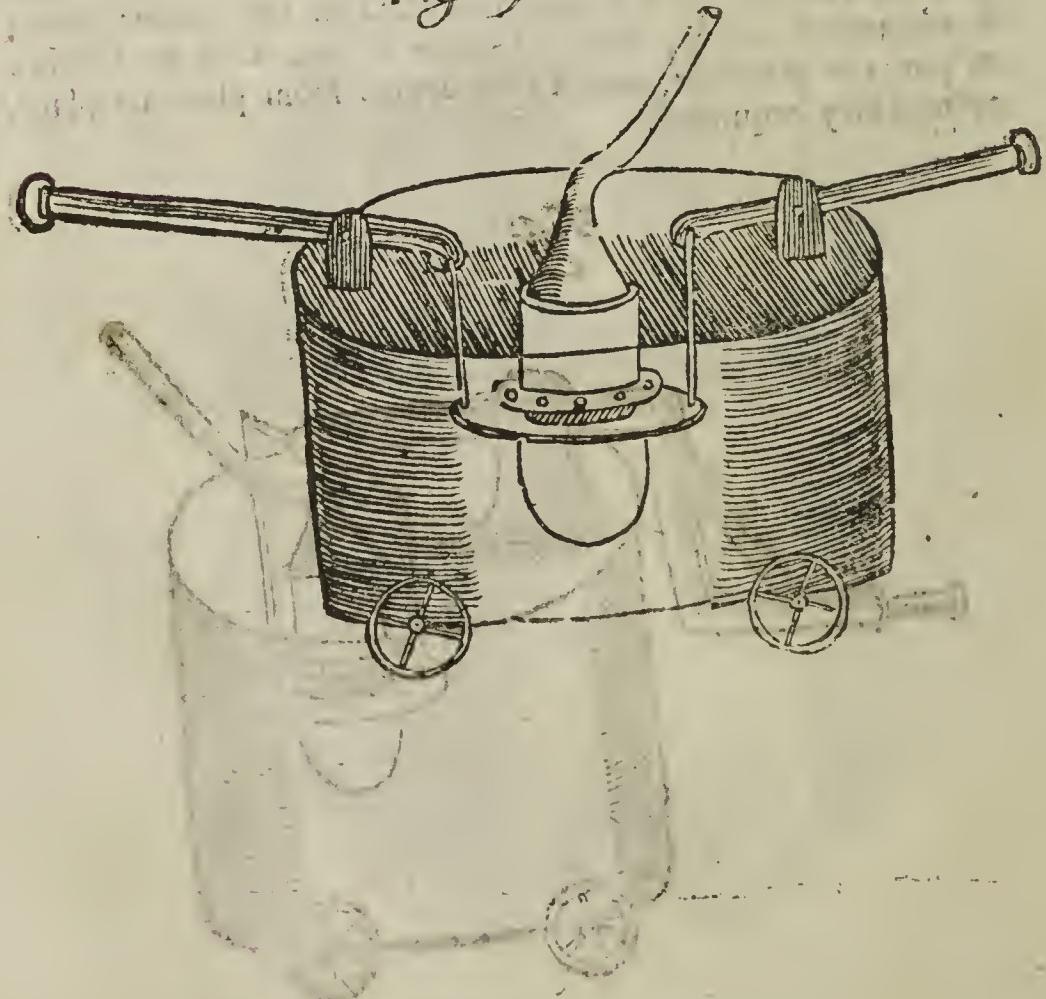


The Description of a second Engin.

A Second Engin I have seen in use, not much unlike the former. The difference betwixt both, is only this ; the lower brasse of this is poysed with two Sweeps, and the other but with one.

For use I account the other altogether as good as this, nay rather the better of the two ; because that this being wrought upon by two severall persons, they cannot alwayes keep a just time one with the other in fetching their stroakes, but they will strike sooner sometimes, and sometimes later, the one than the other.

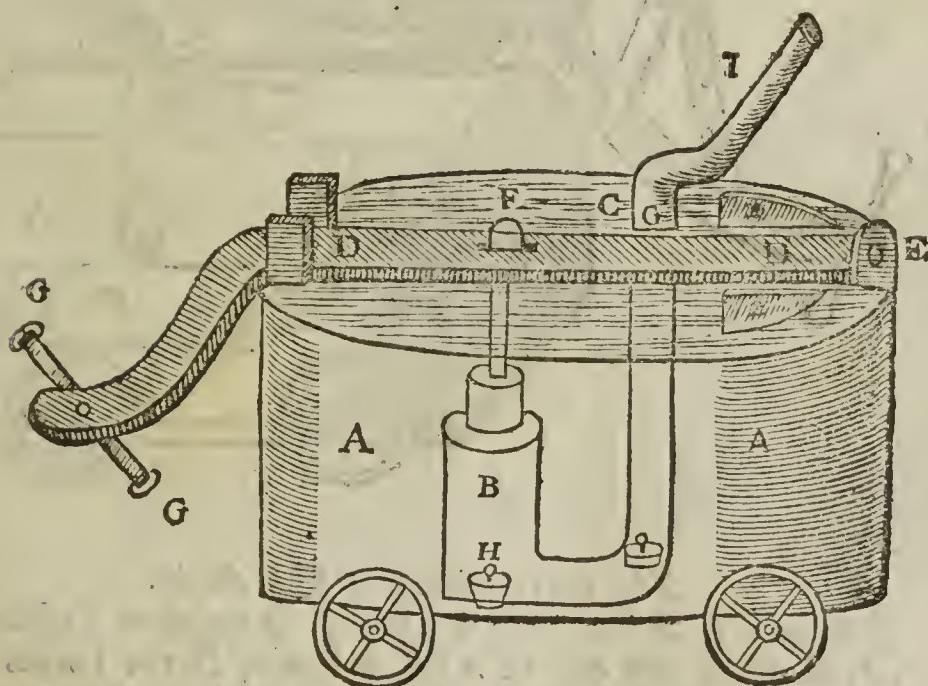
Fig: 9



The Description of a third Engin.

Let A A signify a Cestern, B a Barrell of yron or
brasse, fastned in the midst of the Cestern, with a force
fitted unto it ; this Barrell must be made to turn up out
of the Cestern, at C : and D D a Beam that lyeth a long
the top of the Cestern, and it is made with a joynat at E,
to lift up and down ; in the middle of this Beam there
must be made a mortise hole, wherein the point must bee
joynted, as may be seene at F : G G signifies two
Handles whereby to lift up the Beam, which being lifted
up, will with it draw the Force up also, and so the water
in the Cestern, will come up into the Barrell, at the Sucker
that is at the bottom of it noted H ; now the Beam fal-
ling down, presseth the water violently out at the pipe I,
at the top of the Cestern : Z Z signifieth two holes where-
at the Cestern must continually be supplyed with water.

Cig. 10



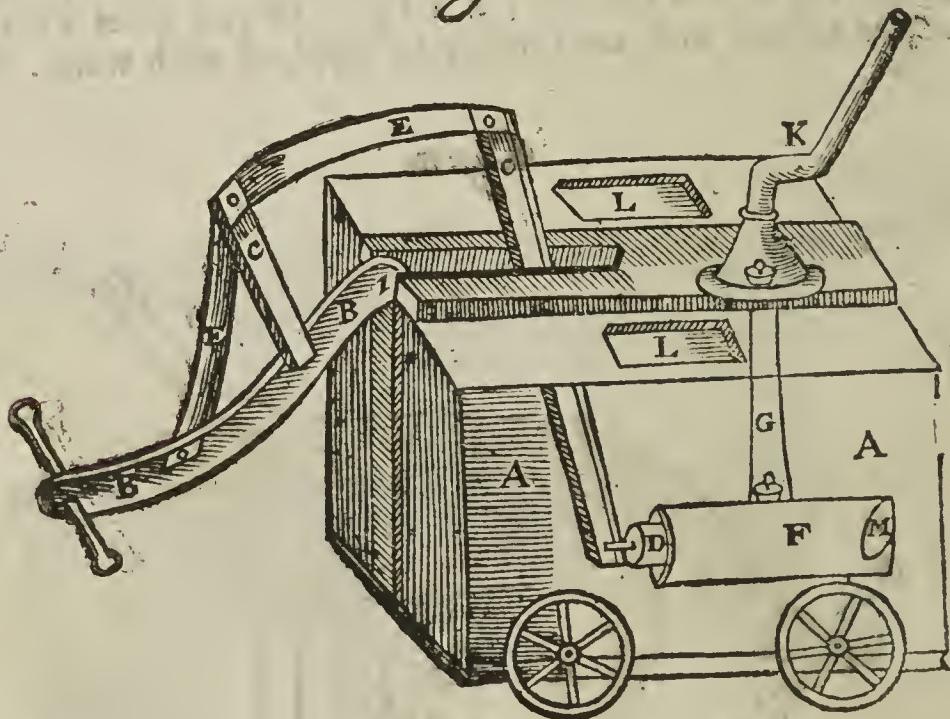
K

WATER-WORKS.

The Description of a fourth Engin.

THe letters A A signifie a Cestern, B B a Beam that is joyned at I, C C two pieces of Timber fastned in the aforesaid Beam ; unto the lowermost end of one of the peeces noted C the Force is linked, and it is noted with the letter D within the Cestern ; E E signifieth a Bar of yron that holdeth C C and B together ; F the barrell of the Force, fastned within two or three inches of the bottom of the Cestern, at the end whereof must bee a Clack or pallet as M : and G a brasse Barrell that proceedeth from the Barrell of the force ; K the pipe out of which the water is forced ; L L two holes to supply the water at.

Fig. 11.



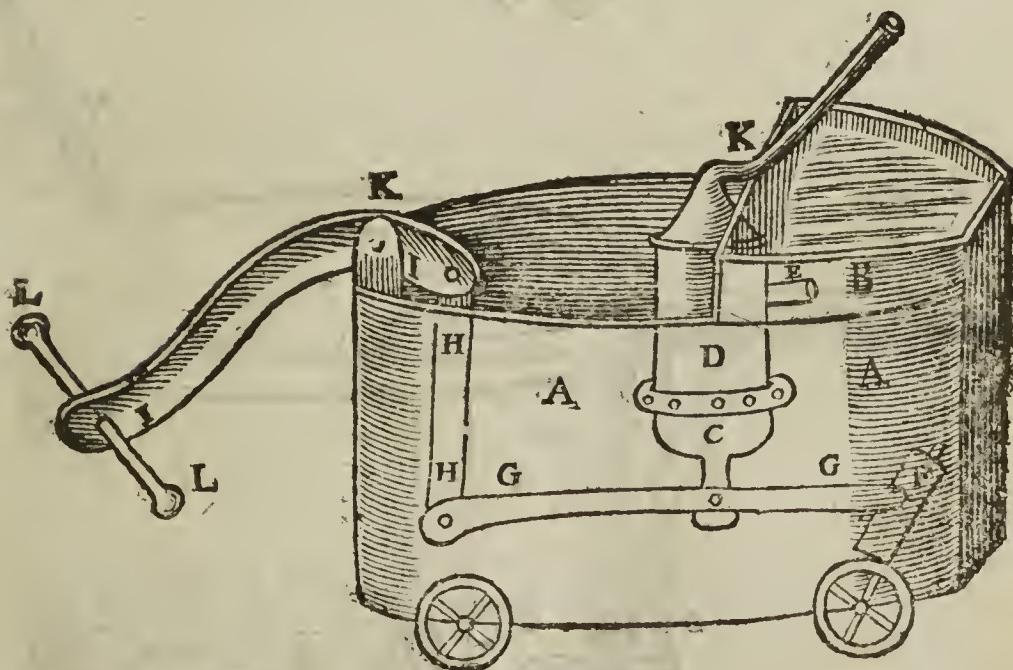
The Description of a fifth Engin.

Suppose A A signifieth a Cestern, B another Cestern placed upon one end of it; C a Force, D the Forces Barrell, with a hollow pyramid Box soldered to the top of it; K the

K. the

K the Pipe for the water to be forced out at. At the bottom of the Cestern B there must be a Pallet or Clack as E, which must passe thorow the side of the Cestern B, and enter the Barrell of the Force; F signifieth a peice of Timber placed athwart one end of the lower Cestern, & let in at both ends with Gudgins, that it may turn round. In the midst of this, there must be a mortise, and in it must be fast pinned another peece of Timber, noted with G G; in the middest wherof must be joyned an yron rod noted with H H, the uppermost end of this rod, must bee joyned unto a heavy peice of Timber as I I, which peice of Timber must be hanged also on the Cestern, by a joyn under K, so that it may be lifted up, and let fall down: L L signifieth two handles to lift the Timber Beam up by. Note that if you lift up the sayd Beam I I, the Force draweth the water out of the Cestern B, into the Barrell D, and when you let slack the Beam, the waight thereof squirtech the water most violently out of the Barrell at the Pipe K.

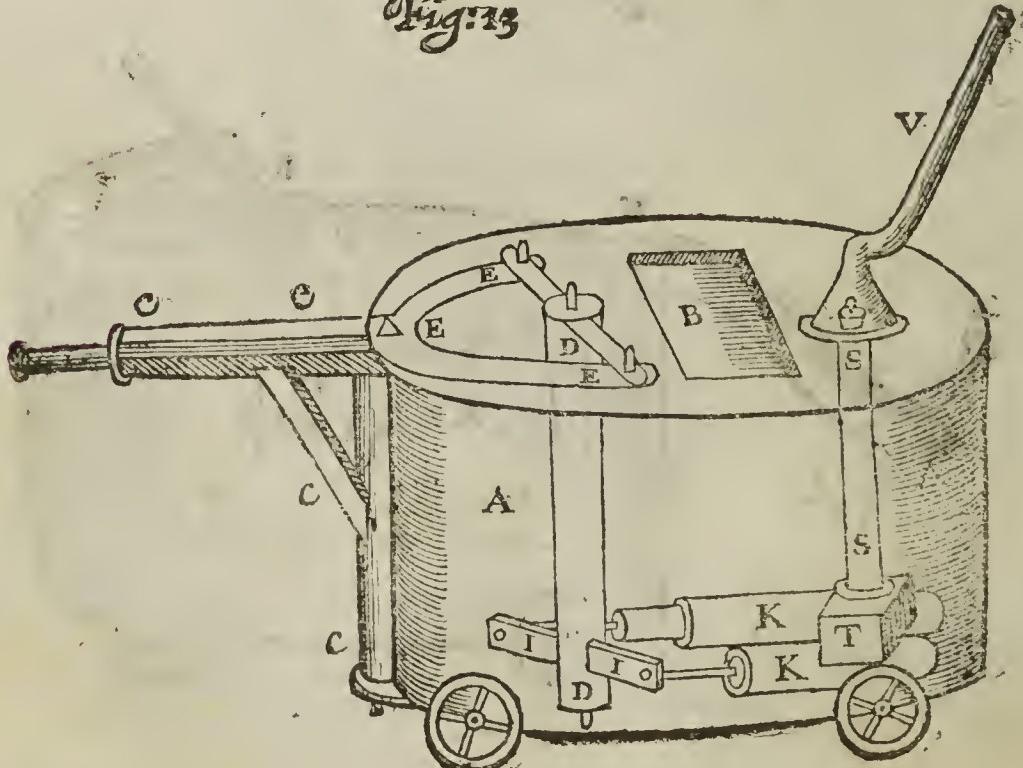
Fig:12



The Description of a sixth Engin.

Let A A signify a Cestern, B a hole to put the water in at, C C C C a Gate to move to and agen, D D a Spindle standing upright in the Cestern towards the Gate's end, E E E a strong semicircular yron, which being fastned unto the Gate, the ends thereof must turn up, and be put thorow two holes of an yron Bar that must passe thorow the top of the Spindle : in the bottom of the Spindle must also be fastened another strong yron Bar as I I, unto each end whereof must be linked a Force. K K signifieth the two Barrels of the aforesayd Forces, having inlet Pallets at their ends ; T a Box at the top of the ends of the Forcers Barrels K K ; this Box hath two Clacks at the bottom answering to two holes made in the sayd Barrels ; S S a pipe that proceedeth from the Box T, this pipe entreth a pyramid Box at the top of the Cestern; and in it is placed a Sucker : V signifieth a pipe proceeding from the top of the pyramid out of which the water is forced.

Fig: 13



C H A P. 9.

Here is nothing (as the Saying goes) bee it never so profitable, but that from the selfe same thing there may arise as great a discommodity, if it exceed the bounds and limits that Nature hath ascribed unto it. What is more needfull and necessary to the fructifying of the Earth than Water, so it be moderate? And what is more hurtfull if it doe superabound? There cannot be a safer Guard about a House, Town, or Citty; nor is there a more domineering Lord or pernicious Enemy, if it be not kept within its circumscribed bounds.

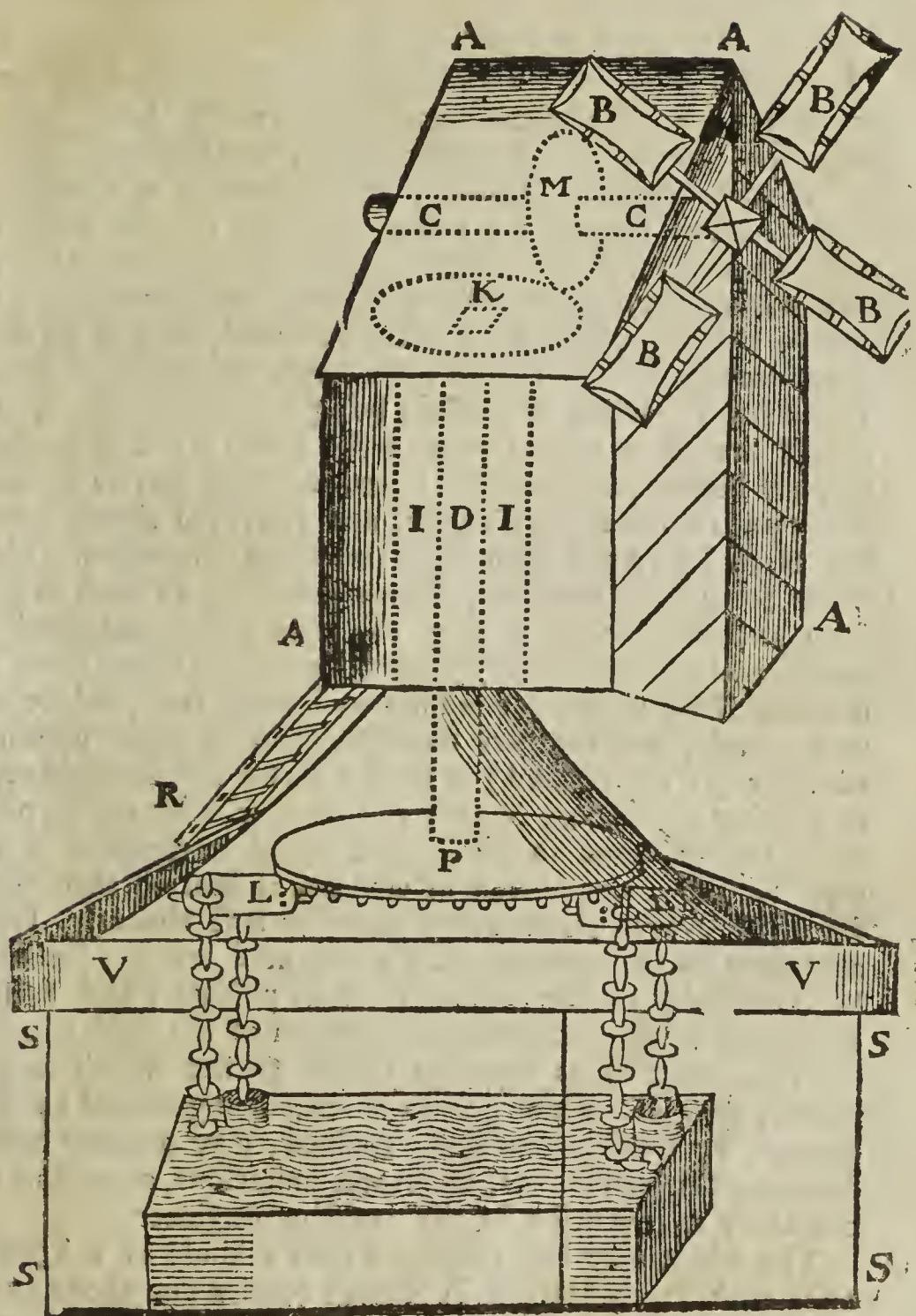
Divers Citties we read of, that it hath wasted and worn away; divers it hath swallowed up: and some there are yet that it would bring to ruine, were it not for the great cost and paines that is continually used to resist the violence of the same. Sundry Fields and Meddowes there are, that are usually overfloated a long time together, which by timely prevencion might by intrenchments be avoyded, and many times otherwayes without much expences. Now there are two main and principall things to be considered in these our proceedings: The first is, whether it bee possible to drayn such and such a Ground. The second, how and by what means to effect the same. The inundacion or overflowing of Grounds, commeth sundry wayes, but principally by two: First, by the overflouing of some adjacent or near adjoyning River: Secondly, by the drayning or descending of rayn waters from some high Grounds. For the first, consider in the first place, whether the Ground you desire to drayn, lie somewhat high, or very low. Secondly, whether there bee a convenient conveyance, without doing hurt unto other Grounds: Thirdly and lastly, whether the Ground be firm and fast, or marish and spongy. Every of these being duly considered and examined, will yeild sufficient testimony of the possibility or impossibility of accomplishing your desire.

Now for the second, by what meanes it is to be performed; which are divers: If it come through the overflouing of some River or Branch of the Sea, the same must be dammed or blocked up with piles, gravell, and such like.

If there be any River near adjoyning to a floated ground, it happeneth oftentimes that the floated ground is so situated; that the hurtfull water may by Trenches voyded into the same; but if by Channels only it cannot be effected, yet the applicacion of certain Mils and Engins may doo it: and here I cannot with silence overpassee the great industry, labor, and expences, of divers in forreyn parts, whereby they have converted divers in-lands, and parts of the Sea, into Fields of Corn, and habitable Townes. It happeneth many times that the ground from whence we would soak the water, lieth somewhat high, and then by petty Channels the water offending may be draynd into a Pond or great Cestern made or placed at the lowest corner of the same ground, and so by a Spout passe the same upon a Mill-wheel, which Mill may be employed for grinding of Corn, for fulling of Cloth, or for cutting of Timber, and afterwards by a Trench conveyed into some by-River. Where there is not such convenience, a Wind-Mill may be placed. And where you can not gayn sufficient advantage from the Wind, Horse-Mils may be placed.

The Description of a Wind-Mill, to convey Water.

Let A A A A signifie the body of the Mill, B B B B the Sayles, C C the Spindle of the Sayles, M a wheele fastened upon the Spindle, D another Spindle having two wheeles fastened unto it, one at the top noted with K, and another at the bottom noted with P, this Spindle is made to turn in the main Piller, upon which the body of the Mill is made to turn; the sayd piller is noted with I I. The Wheel P moveth two other wheeles noted each of them with L: these two wheeles turn two Chaines that are put over them. R signifieth the Ladder for to goe up to the Mill. S S S S a Scaffold whereon the Mill is placed. V V a Battlement round about the top of the Scaffold, unto the inner side of this Scaffold, are fastned divers yron rings, unto which by meanes of a cord that is to be fastened unto the Ladder noted R, the Mill is to bee bound, which way soever the Wind sitteth. Marke the Figure following.



C H A P. 10.

Of Water-works for Recreacion and Delight: in generall.

Three principall wayes there are, of composing Garden works for Recreacion and Delight; The first is, when the water by its naturall and proper course, being conveyed by Pipes from some higher place, breaketh out forcibly in the descent. Secondly, when there is a steaming water passing thorow a Garden, sufficient to give motion unto an Engin, which Engin may be made to mount the sayd water by forces or other wise, as I have already sufficiently taught; which water being mounted, may in its descent produce sundry motions for divers delightfull objects. The third is, when the water lying remote and levell, is eyther drawn by some Device in the Garden and so forced to some higher place, or else forced by some Device at the Fountain to some high Turret, and conveyed thence unto the Place by pipes unto some artificiall invencion. The water being once mounted, it may serve for all both ordinary and extraordinaty uses, the main pipe being divided into branches, each branch having its cock. Indeed there is not any thing whereby one may with more ease produce so many sundry and contrary motions, than by water mounted: for (as I have sayd) it is of a massie subtile substance, and being captivated, seeketh to free it selfe by every passage, though never so little, and being interrupted in its way by the interposicion of wheeles, it beareth them forward, or swayeth them down more or lesse violently. First according to the quantity of the mounted water; Secondly, according to the widenesse of its passage; and lastly, according to the distance and scituacion of the sayd wheels, from the place of its erpcion: these greater wheels being moved, they move lesser, and the lesser being moved by the greater, by Devices artificially applyed, may produce other Motions, Muzicall sounds, and Antik imitacions, according to the fancy & invencion of the Artist or Engineer.

The whole may bee contrived into a kinde of a Crosse, beset with stately Statues, in severall Stories one above another, the water ascending the midst, and privately descend-

ing

ing upon certain wheels, which may turn other wheels, whereupon may be fixed divers Images ; and so there will be a circular Mocion. By turning certain lower cocks, or drawing back shuts, other Mocions may bee made.

Or else it may be contrived into a Rock, which may have a doore for the Gardiner to enter in at, who beeing throughly acquainted with the same, may by turning of Cocks or wheels, or drawing back shuts, passe the water from side to side, according as the Mocions are made to move. The Rock may be set forth with the shapes of Serpents, Beasts, and other, either dreadfull or delightfull Spectacles ; some receiving mocion, others changing their posture, either from the water, or else from the wheels that force the water.

Or it may be contrived into a Rock bedect with Shels, Glafs, and glistering Stones', rudely & confusedly compiled : on the out side within the Rock, may be made a pretty conceited Dining Room, hanged with Tapistry, or wildly and antikly paynted. Muzyk also may be privately disposed upon one side of the Room. This Room may be so made, as it may be changed in an instant, and that more than once or twice, and the Muzyk to change accordingly.

Or it may be contrived into a Fountain beset with divers naked Figures.

Or you may place divers immages in sundry and severall parts of the Garden, the more antik and ridiculous, the more pleasant and delightfull. These being made hollow, or perforated in divers parts, the water may bee sent unto them, by turning of divers stock Cocks, and so spin out thereat, so that the ignorant person can walk no where to gape about, but he shall be washed whensover the Gardiner pleafeth, or if his own folly be such as to be medling with what he is unacquainted withall.

C H A P. II.

Of Voyees, Cals, Cryes, and Sounds.

IT is necessary to speak somwhat here concerning Voyces, Cals, Cryes, and Sounds. They are known among some Shopkeepers, by the names of Cals ; and there are long white Boxes

WATER-WORKS.

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Boxes of them, which are transported hither from France, each Box contayning eleven in number, the names whereof follow: a Koo-ko, a Peacock, a Bittern, a Levret, a Stag, a Quayl, a small Bird, a Hare, a Drake, a Hedg-hog, a Fox.

They are seldom sold alone, and altogether at a very dear Rate. There is no difficulty in their making, nevertheless, for to satisfy the expectacion of some, I have not only set down their Forms, but also explicated the same so far as I thought needfull. Certain others there are, that I found out when I made the forenamed, and I doubt not but if another shall essay to make them again, he may ad some other unto their number.

Of the Kooko pipe..

First you must turn a peece of wood hollow, like unto a Steel-stick, about three inches deep. Let the diameter of the hollownesse towards the top, bee about one inch and a quarter or lesse; then make a stoppell unto it about a quarter of an inch thick, and cut a little slip from off one side of it: then put it into the mouth of the other turnd wood, and cut a little square hole in the sayd turnd peece, so that the lower side of the sayd hole may be equal with the bottom that you put in: then bore a small hole in the round end of the hollow turnd wood, about the bignesse of the tag of a point; also bore such another in the middle of the bottom that you put in: then hold it between your thumb and middle finger, with the flat end towards your mouth, and blow into the pipe hole of the same, observing this; that your blast must be doubled according to the number of syllables that the Voyce doth contayn, as *Koo-ko*: and towards the end of the second syllable, you must stop the top of your fore-finger upon the hole of the round end of the pipe, which maketh the second syllable sound flat, and so it will give the tru & lively sound of *Kooko*: which when it is perfect and liketh you, you may gleu the bottom fast in. The same pipe giveth the right and lively sound or cry of an Oul, as *Hoo ho ho ho hoo*: but you must (as I have sayd) double your breath according to the number and pronunciacion of the syllables contayned in the sayd Voyce, the first whereof is long, the next three short, and the last long.

A.

A Cock.

I Have produced the Voyce of a Cock out of the former Pipe, only by boaring 4 holes round about the side towards the small end, one opposit to the other, and stopping the two little holes at the ends.

The Drake, Bittern, Hare, Levret, Peacock, and Hedg-hog.

THe Pipes that sound the Drake, Bittern, Hare, Levret, Peacock, and Hedg-hog, are almost made after one manner, and it is the size alone that alters the Voyce; the descripcion of which I have set down in generall, as followeth:

They consist each of them of foure severall parts, one to be skrewed or wrung upon another. The first part is like the mouth of a Cornet, and it is noted with the Letter A; the second, is a peece of wood made hollow quite thorow, into one end whereof the peece A is to be wrung, and the other end is to be upon another peece, as C, but this part before such time as you wring it on, must have the following brasle fastened in it.

Make or cause to bee made, a piece of brasle like unto a Kane split in the middle as A, fit a Cover unto it, of thin yellow Latten, such as they tag points withall, that it may lie close all over the top of the hollownesse of the aforesaid peece of brasle. Let this Tongue or Cover bear a little from the brasle, towards that end that is closed. Note that the middlemost wooden peece, must be of sufficient widenesse for the Tongue to play in without let or hinderance. The like brasses (but of different sizes) must be made: for every of the forenamed pipes: for it is the size of the Brasle (as I have told you) that alters the voyce.

A Stag and Fox.

THe Stag and Fox Cryes, are made like unto the aforesaid; only their Tongues bear a little more from their brasses, and there is no Cornet mouth upon them.

The Hog, Cow, and Lyon.

THe Hog, Cow, and Lyons Cryes, may be imitated after the same manner as the Stag and Foxes, but the
L 2 brasses

brasses of these must bee fuller, and the lowermost wood wherein the brasses must bee fastned, must bee longer.

A Plover and a Puppy.

Make a small brasse in like manner as you made the Peacocks; and if you blow at the close end it will yeild the voice of a Plover, but if you put the open end into your mouth, and draw in your breath, it will give a sound just like the whining of a Puppy.

A Call for small Birds.

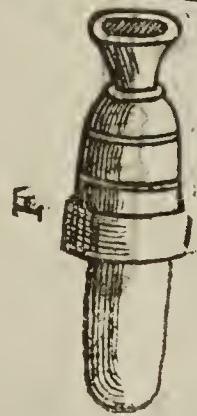
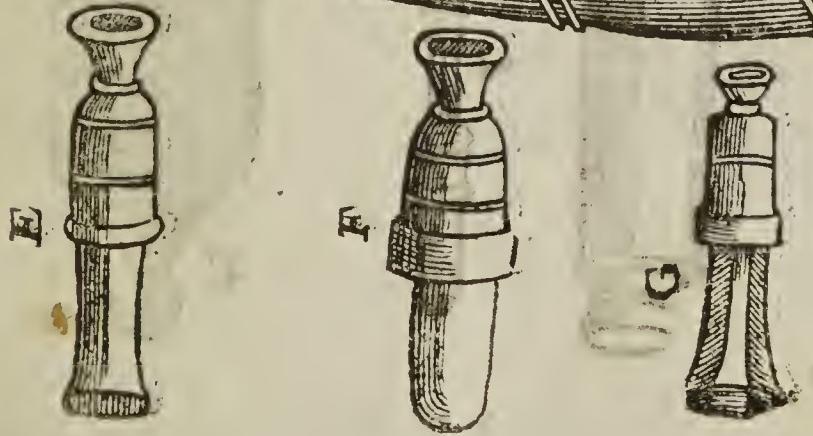
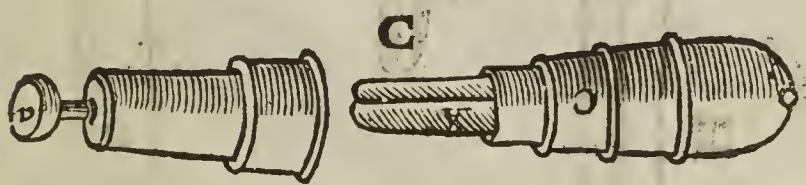
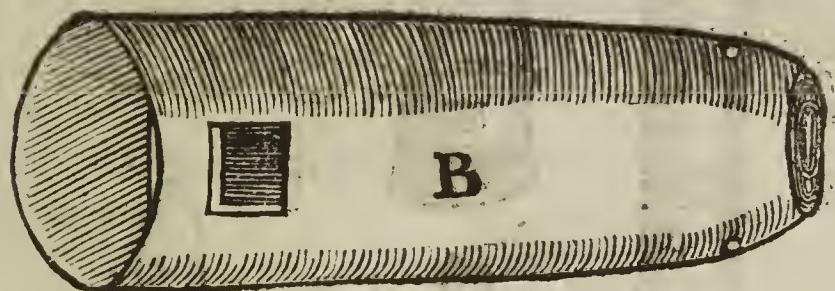
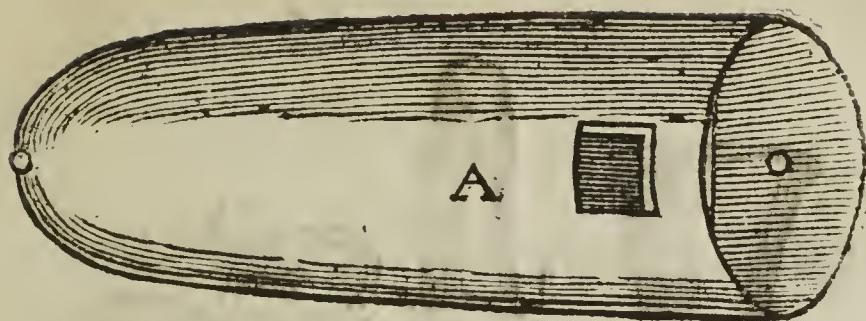
THIS is in all respects made like unto a whistle, only there is a little hole at the lower end, as big as you may put the tag of a point into.

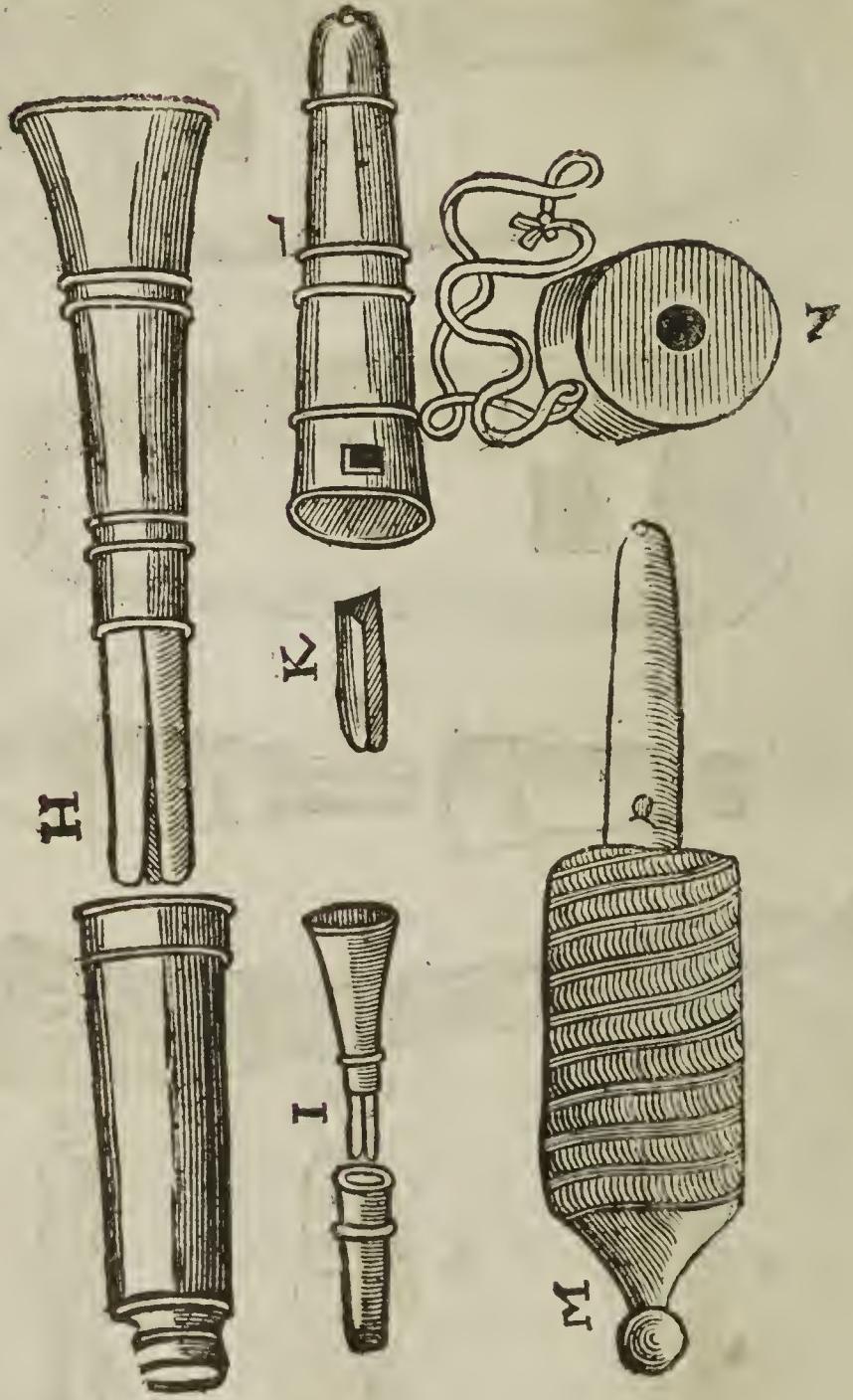
A Quayl Call.

A Quayl Pipe or Call is a small Whistle, and there is over the top of it some wrched wyer, which must bee wrought over with leather ; hold the Whistle in your left hand, and the top of the leather between the fore-finger and thumb of your right hand, and by pulling straight the said leather, and letting it slack nimbly, it will sound like the cry of a Quayl.

A Lark, Linnet, and Kyte.

THE former Call may be sounded by a Sparrow Call, wherewith I have heard a Frenchman sound the singing of a Lark ; also, I have heard him by the same, sound the whistling of a Linnet, the same Call will sound the voyce of a Kyte and Quayl. An Irishman I have seen (which I much wonder at) imitate with his mouth the whistling of a Blackbird, a Nightingall, and Lark, yea almost of any small Bird, as exquisitely almost as the very Birds themselves ; and all is by the cunning holding the artificiall blade of an Onyon in his mouth. The Figures follow, and every one of them is marked with a Letter. A signifieth the Call for a Kooko and an Oul. B for a Cock. C for a Drake. D for a Bittern. E for a Hedg-hog. F for a Levret. G for a Peacock. H a Stag. I for a Fox. K for a Plover and a Puppy. L for small Birds. M a Quayl. N for a Kyte, Lark, and Linnet.





The composing of all manner of
Fier-Works
For Triumph and Recreacion,

Plainly and Exactly taught

By JOHN BATE.



L O N D O N

Printed by R: Bishop for Andrew Crook, at the Green
Dragon in Pauls Churchyard. 1654

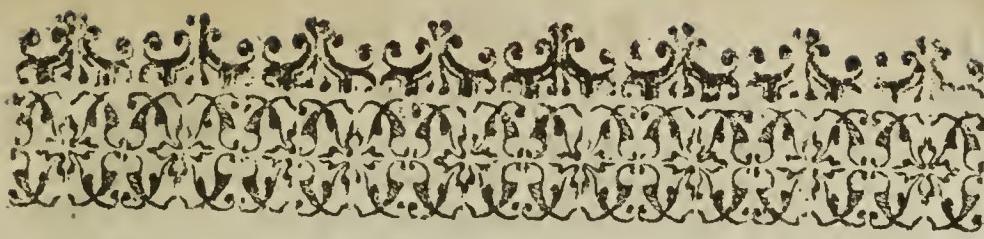
To the Reader.



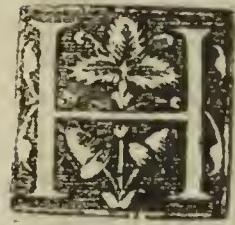
Ourtous Reader, I once desisted since I began this VVork, by reason of the occurrence of certain Authors, that contrary unto my knowledge had laboured so fully herein : but after Consideracion had (that for the most part they were but Translaciones) I thought it might be no lesse lawfull and commendable for me than for others, to communicate unto such as are yet desirous of further informacion, that wherein I have bestowed both cost & pains. Notwithstanding, I have so used the matter, as that I might not derogate from the Estimacion had of others to encrease my own. Read it throughly, judge indifferently, and if thou likest it, practise consideratly. If thou art ignorant herein, I am sure it will instruct thee ; and though well experienced (which perhaps thou art) I make no question, but that thou mayst finde somwhat which thou hast not heard of before : So farewell.

Your Well-willer,

JOHN BATE.



Of Fier-Works.



Aving ever found (in conference with divers desirous of instruction in any Art or Science whatsoever) that those things whose causes have been obvious unto apprehension, have more affected the Learner; I therefore think good (before I come to the matter it selfe) to set down some few *Præcognita* or *Principles* (as I may so call them) whereby such as are ingenious (upon occasion) may inform themselves, if they stand in doubt of the cause of any thing that is hereafter taught.

Certayn Præcognita or Principles, wherein are contayned the Causes and Reasons of that which is taught in this Part.

1 The four Elements, Fier, Ayer, Water, and Earth, are the *prima Principia*, I mean the materials whereof every sub-lunary body is composed, and into the which it is at last dissolved.

2 Every thing finding a dissolucion of those *natura categorei*, that is, means whereby their *principia* are connected and joyned together, their lighter parts ascend upwards; and those that are more grosse & heavy, do the contrary.

3 It is impossible for one and the selfe same body to possess at one time two places; It followeth therfore, that a dense body rarified and made thin, eyther by actuall or potenciall Fier, requireth a greater quantity of room to be conteyned in, than it did before. Hence it is, that if you lay your hand upon a Glasse, having a straight mouth reverst into a Dish of water, it rarifieth the Ayer contayned therein, and makes it break out thorow the water in bubbles. Also, that Gun-powder inclosed in the Barrell of a

Gun, being rarified by Fier, applyed unto the touch-hole, it seeketh a greater quantity of room, and therefore forceth the Bullet out of the Barrell. This is called violent mocion.

According unto the strength and quantity of a dense body rarified, and according unto the form and length of its inclosure, it forceth its compressor further or nearer at hand.

Thus much shall suffice to have spoken concerning the *Præcognita*: Now I will passe *ad majora, & ad magis necessaria*: to wit, those necessary Instruments, and severall sorts of Ingredients, that ought to be had in readinesse.

As for the instruments they are these ; Morters and Pestles, Serces; also severall sorts of Formers, Paper, Parchment, Canvas, Whipcord, strong binding Thread, Gleu, Rozin, Pitch, with divers Vessels meet to contain and mingle your Compositions in. The ingredients like wise are chiefly these, Salt peter, Rochpeter, Sulphur, Charcoal, good Gunpowder, Filings of Steel, oyl of Peter, and spirit of Wine.

Instructions for chusing your ingredients.

Salt peter is very good, if that being layd upon a boord, Sand Fier put to, it rise with a flamed ventosous exhalacion raysing on scum, nor leaving no pearl, but only a black speck burnt into the boord.

The best Brimstone, is quick Brimstone, or live Sulphur, and that sort is best that breaketh whitest ; if this cannot be gotten, take of the whitest yellow Brimstone.

The best Coales for use are the Sallow, Willow, Hazell, and Beech ; only see they be well burnt. Every of these ingredients must be poudred finely and searsed.

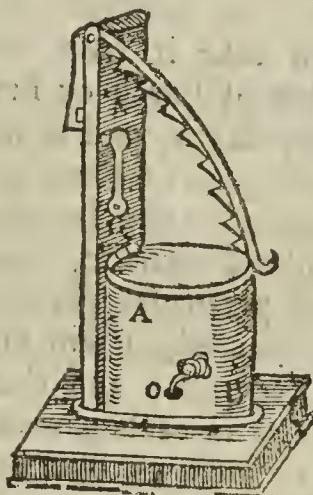
All kindes of Gunpowder are made of these ingredients impasted, or incorporated with Vineger, or Aquavitæ, and afterward grayned by Art. The Salt peter is the Soul, the Sulphur the Life, and the Coales the Body of it. The best sort of pouder may be distinguished from others, by these signes :

- 1 If it be bright and incline to a bleuish colour.
- 2 If in the handling it prove not moyst, but avoydeth quickly.
- 3 If

3. If being fired, it flash quickly, and leave no dregs nor
settlings behinde it.

A Device to try the strength of divers sorts of Gunpowder.

If so be you have at any time divers sorts of Gunpowder, and it is your desire to know which of them is the strongest, then you must prepare a Box, as A B, being foure inches high, and about two inches wide, having a Lid joynted unto it. The Box ought to be made of yron, brasse, or copper, and to be fastned unto a good thick plank, and to have a touch-hole at the bottom, as O, and at that end of the Box where the hinge of the Lid is, there must stand up from the Box a peece of yron or brasse, in length answerable unto the Lid of the Box: this peece of yron must have a hole quite thorow it, towards the top, and a spring, as A G, must bee screued or riveted, so that the one end may cover the sayd hole. On the top of all this yron, or brasse that standeth up from the Box, there must be joynted a peece of yron (made as you see in the figure), the hinder part of which is bent down-ward, and entereth the hole that the spring covereth; the other part resteth upon the Lid of the Box. Open this Box Lid, and put in a quantity of pouder, and then shut the Lid down, and put Fier to the touch-hole at the bottom, and the pouder in the Box being fired, will blow the Box Lid up the notches more or lesse, according as the strength of the pouder is: so by fyring the same quanity of divers kindes of pouders at severall times, you may know which is the strongest. Now, perhaps it will be expected that I should speak of the making of Salt peter, Gunpowder, Coales, with the refining of Sulphur: but because they are so commonly to bee had, and to be bought at better rates then I know they can bee made by any that intend it for their private use, I have



for-born it : There are divers I am sure that would willingly be in action : I have thought fitting therefore to set down the collection of naturall Saltpeter, which is a kinde of white excrescence growing upon stone-walles, and (as I have seen great store) in the arches of stone-bridges. First therefore gather this white excrescence; and ad unto it Quick Lyme, and Ashes, mingle them and put them into a halfe-Tub that hath a hole to draw the liquor out at ; then put into this halfe-Tub warm water, and let it stand untill all the Peter be dissolved ; let it then drayn out at the hole by little and little, and if the liquor be not cleer, double a broun paper, and put it within a Tunnell, and strayn the liquor thorow it. Then boyl it and scum it untill it bee ready to congeal, neither too hard, nor yet too tender : then take it from the fier; and put it into shallow vessels, either of Earth or Brasse ; set them in a cold place two or three dayes, and it will shooft into ysicles, and this is called Roch-peter. Thus much for the ingredients. Now I am come unto the Formers, the number whereof I cannot certainly determine, because it dependeth upon the variety of each particular persons invencion. Now that I may formally proceed, I will first make some distinction of each kinde in generall ; and then I will speak of every particular contained in each generall. Fier-works are of three sorts.

1 Such as operate in the Ayer, as Rockets, Serpents, Raining Fier, Stars, Petards, Dragons, Fier-drakes, Fiends, Gyronels, Fier-wheels, or Balloons.

2 Such as operate upon the Earth, as Crackers, Trunks, Lanterns, Lights, Tumbling Bals, Saucissions, Towers, Castles, Pyramids, Clubs, Lances, Targets.

3 Such as burn in or on the water, as Rockets, Dolphins, Ships, Tumbling Bals, Mermayds.

Part of either of the three kindes are simple, and part are compounded ; part also are fixed, and part moveable. First, I will treat of the divers compositions, and then of the Formers, Coffins, and manner of composing every of them.

Of the divers Composicions of Fier.

Works for the Ayer.

First, of the compositions of Fier-works, for the Ayer ;
 And therein first I will speak of the compositions for
 Rockets, because that all moveable Fier-works have their
 motion from the force of them accordingly applyed.

*Composicions for Rockets of all sizes, according unto the pre-
 scription of the noted Professors, as Mr. Malthus,
 Mr. Norton, and the French Author, Des Re-
 creacions Mathematiques.*

Take this from me, whosoever thou art that desirest to
 be instructed. Never rely absolutely upon a composition,
 nor make many Rockets; or other sorts of Fier-works of a
 composition, untill such time as thou hast made triall once
 or twice of the same, lest that thou misse of thy aym, but
 after triall you may proceed and perform your intencions
 with credit. By the compositions you may make a guesse,
 and as they prove you may allay or quicken them accor-
 dingly.

A composition for Rockets of one Ounce.

Take of Gun-pouder, Saltpeter and Charcoall, of each
 one ounce & a halfe, mingle them together, and it is done.
 Note here (as I told you before) that all your ingredients
 ought to be first poudred by themselves, and afterwards
 mixed very well together.

A Composition for Rockets of 2 and 3 Ounces.

Take of Gunpoudre foure Ounces and a halfe, Saltpeter
 one Ounce, mix them together.

A Composition for Rockets of 4 Ounces.

Take of Gunpouder foure pounds, Saltpeter one pound,
 Charcoal foure ounces: mingle them together.

Another Composition for Rockets of 4 Ounces.

Take of Gunpowder four pounds, Saltpeter one pound, Charcoal four ounces; Brimston halfe an ounce, mingle them together.

A Composition for all middle siz'd Rockets.

Take of Gunpowder one pound, two ounces of Charcoales; mingle them.

A Composition for Rockets of 5 or 6 Ounces.

Take of Gunpowder two pound 5 ounces, of Saltpeter halfe a pound, of Charcoal 6 ounces, of Brimston and yron scales, of each two ounces: mingle them.

A Composition for Rockets of ten or twelve Ounces.

Take of Gunpowder one pound and one ounce, Saltpeter four ounces, Brimston three ounces, and a halfe, Charcoal one ounce: mingle them.

A Composition for Rockets of one pound, or two.

Take of Saltpeter twelve ounces, Gunpowder twenty ounces, and Charcoal three ounces, quick Brimston and scales of yron, of each one ounce: mingle them.

A Composition for Rockets of eight, nine, and ten pounds.

Take of Saltpeter eight pounds, Charcoal two pounds, twelve ounces, of Brimston one pound four ounces. Note that no practicioner (how exact soever) ought to rely upon a Receipt, but first to try one Rocket, and if that be too weak, add more Gunpowder, if it be too strong let him add more Charcoal, untill he finde them fly according unto his desire. Note that the Charcoal is only to mittigate the violence of the pouder, and to make the tayl of the Rocket appear more beatifull. Note also that the smaller the Rockets be, they need the quicker Receipts, and that in great Rockets, there needeth not any Gunpowder at all.

The Composition for middle siz'd Rockets may serve for Serpents, and for rayning fire, or else the Receipt for Rockets on the ground, which followeth hereafter.

Compe-

Composicions for Starrs

Take of Saltpeter one pound, Brimston halfe a pound, Gunpouder foure ounces; this must be bound up in paper or little ragges, and afterwards primed.

Another Receipt for Starrs

Take of Saltpeter one pound, Gunpouder and Brimston of each halfe a pound; these must be mixed together, and of them make a paste, with a sufficient quantity of oyl of peter, or else of fayr water; of this paste you shall make little Bals and roul them in dry Gunpouder dust; then dry them and keep them for your occasions.

Another

Take a quarter of a pint of *aqua vitae*, and dissolve therein one ounce and a halfe of Camphir, and dip therein Cotten bumbast, and afterwards roul it up into little Bals; afterwards roul them in pouder of quick Brimston, and reserve them for use.

Another Receipt for Starrs, whereof you may make Fiends and divers Apparicions according unto your fancy.

Take Gum-dragant, put it into an yron pan, and rost it in the Embers; then pouder it, and dissolve it afterwards in *aqua vitae*, and it will become a jolley, then strain it; also dissolve Camphir in other *aqua vitae*. Mix both these dissolucions together, and sprinckle therein this following pouder.

Take Saltpeter one pound, Brimston half a pound, Gunpouder three pound, Charcoal half a pound; when you have mingled and stirred them well together, mix them well with the aforesaid jolley, and then make it into little Bals, or into what fashion else you please, then cool them in Gunpouder dust, and keep them for use,

Composicions for all Receipts of Fier.works, that operate upon the Earth

For Rockets there needeth only Gunpouder finely beaten and searc'd.

Likewise for all the other sorts, searc'd Gunpouder will serve,

Serve, which may be abated, or alayed with Charcoal dust at your pleasure.

Composicions for Fier-works, that burn upon or in the water.

A Receipt for Rockets that burn upon the water.

Take of Saltpeter one pound, Brimston half a pound, Gunpowder half a pound, Charcoales two ounces. This composition will make the Rockets appear with a great fiery tayl. If you desire to have it burn clear, then take of Saltpeter one pound, three ounces of Gunpowder, Brimston half a pound.

A Receipt of a composition that will burn and feed upon the water.

Take Mastick half a pound, white Frankinsence, Gumsandake, quick-Lime, Brimston, Bitumen, Camphir, and Gunpowder, of each one pound and a half, Rozin one pound, Saltpeter four pounds and a half: mix them all together.

A Receipt of a composition that will burn under water.

Take Brimston one pound, Gunpowder nine ounces, Refined Saltpeter one pound and a half, Camphir beaten with Sulpher and Quicksilver; mix them well together with oyl of Peter, or Linseed oyl boyled, untill it will scald a feather. Fill a canvas Ball with this composition, arm it, and ballast it with Lead at the bottom, make the vent at the top, fire it well and cast it into the water, and it will fume and boyl up srouly.

A Receipt of a Composition that will tind with the water

Take of oyl of Tile one pound, Linseed oyl three pounds, oyl of yelks of Eggs one pound, new quick-Lyme eight pound, Brimston two pounds, Camphir four ounces, Bitumen two ounces; mingle all together.

Another

Take of Rochpeter one pound, flouer of Brimston nine ounces, Coales of rotten wood six ounces, Camphir one ounce

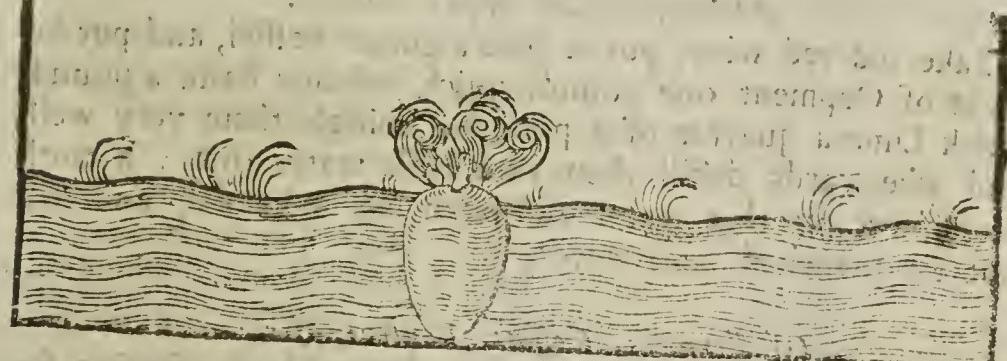
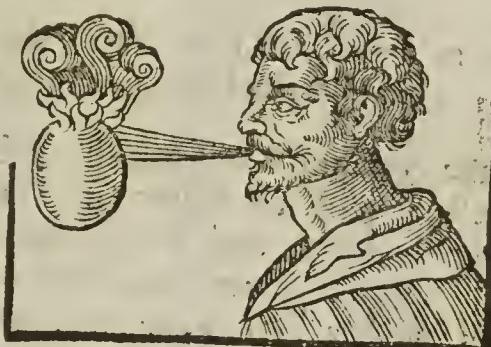
ounces and a halfe, oyl of Egges, and oyl of Tyle, enough to make the mixture into a paste.

Or take Callamita one pound, Salt-Niter and Asphaltum, of each foure ounces, quick Brimston three ounces, liquid Varnish 6 ounces: make them all into a paste.

Put either of these compositions into a pot wherein is quick Lyme, so that the Lyme come round about the paste; then lute it fast, binde it close with wyers, and set it in a Lyme-keel a whole baking time, and and it will become a stōne that any moisture will tind.

If you make a hole in the top of an Egge, and let out all the meat, and fill the shell with the following pouder, and stop the hole with wax, and cast it into a running water, it will break out into a fier.

Take of Salt-Niter, Brimston, and quick Lyme, of each a like quantity, mix them.



How to make Stouple, or prepare Cotten-week to prime your Fier-works with.

Take Cotten-week, such as the Chandlers use for candles, double it six or seven times double, and wet it thoroughly in Saltpeter water, or aquavite, wherein some
N Camphir

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Camphir hath been dissolved, or for want of either, in fayer-water ; cut it into divers peeces, roul it in mealed Gunpowder, or pouder and Sulphur ; then dry them in the Sun, and reserve them in a Box where they may lie straight, to prime Starres, Rockets, or any other Fier-works.

How to know the true time, that any quantity of fired Gun-match shall doe an exployt at a time desired.

Take common Gun-match, rub; or beat the same a little against a post to soften it ; then either dip the same in Saltpeter water, and dry it again in the Sun, or else rub it in a little pouder and Brimston beaten very small, and made liquid with a little aqua-vitæ, and dried afterwards ; try first how long one yard of match thus prepared will burn, which suppose to be a quarter of an houre, then four yards will be a just houre. Take therefore as much of this match as will burn so long as you will have it to bee ere your work should fier, binde the one end unto your work, lay iugose pouder under, and about it lay the rest of the match in hollow, or turning so that one part of it touch not another, and then fier it.

A Water called Aqua Ardens.

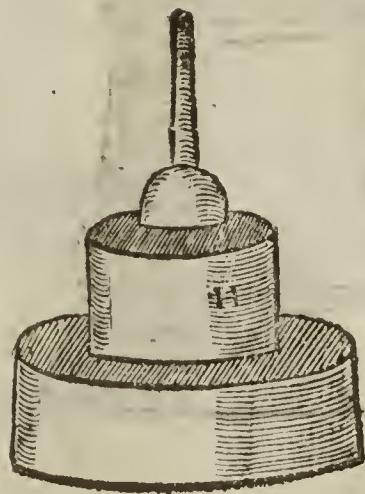
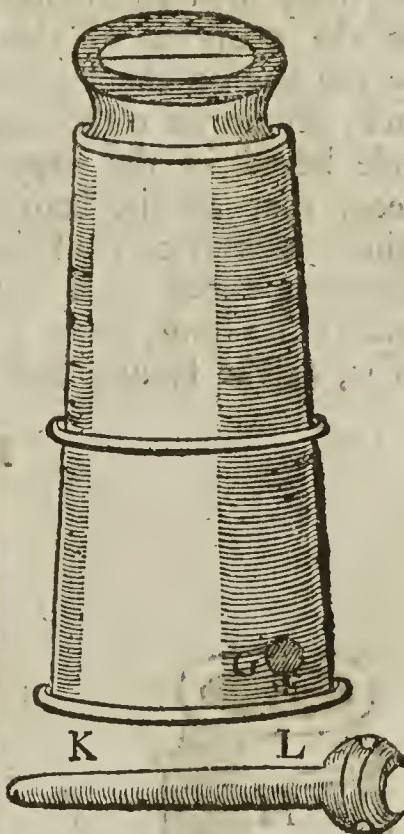
Take old red wine, put it into a glazed vessell, and put into it of Orpment one pound, quick Sulphur halfe a pound, quick Lime a quarter of a pound ; mingle them very well, and afterwards distill them in a Rose water still : a cloth being wet in this water will burn like a kandle, and will not be quenched with water,

Of Formers, Coffins, Roulers, &c.

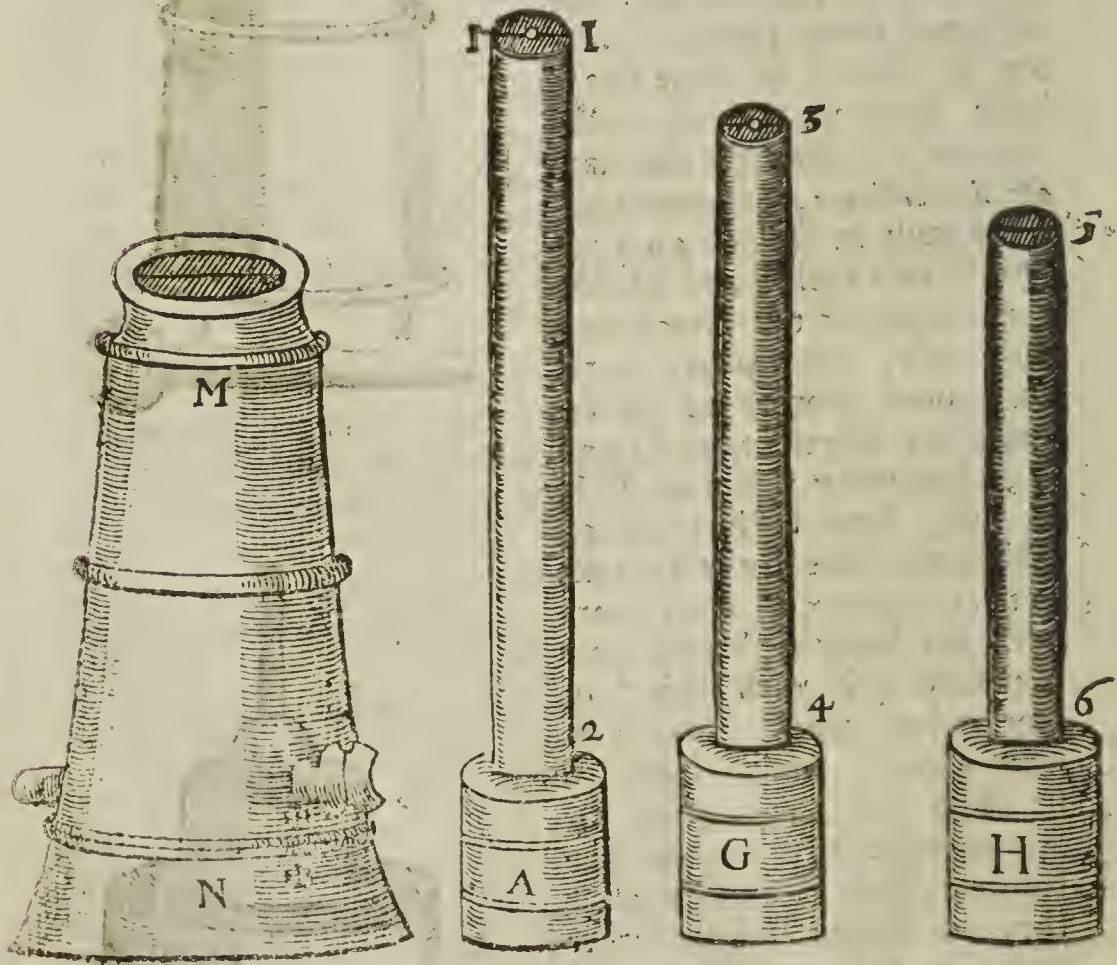
The Formers are instruments wherewith the Coffins for the Fier-works are made and formed, whereof in order ; and first for Rockets that operate in the Ayer. The Formers for Rockets consist of two parts, represented by the two next figures following, the uppermost whereof representeth the body of the Former, which must be made of Maple, Wallnut-Tree, or of other close and well seasoned wood, or

or else of brass, seven inches wanting halfe a quarter in length, turned equally, and exactly hollow quite through, the diameter of whose hollownesse, represented by the Line at the top marked at each end with A E, must bee one inch and a quarter : the breech of the Former is represented by the lowest Figure, the upper part whereof must bee made to enter the body of the Former: the heighth of the whole breech, beside the broach is 3 inches and a halfe; it entreth the body of the Former, one inch and three quartets ; the top of it must be made like a halfe Nutmeg, in the midst whereof (as Mr. *Malthus* and *des Recreatioines Mathematiques*) there must be fastned an yron broach two inches and a halfe long; then put the breech into the body, and pierce them both quite thorow as the Figures doe represent, at G and H; then make a pin as K L, to pin them both together, which must bee made to take out at pleasure: then mark both the body & breech near the sayd hole with this * or any other mark, that you may thereby know how to fit them afterwards. But Mr *Norton* willeth for to bore the Rockets with a Bodkin after they are made: But the other way (in my opinion) I hold the better.

N 2



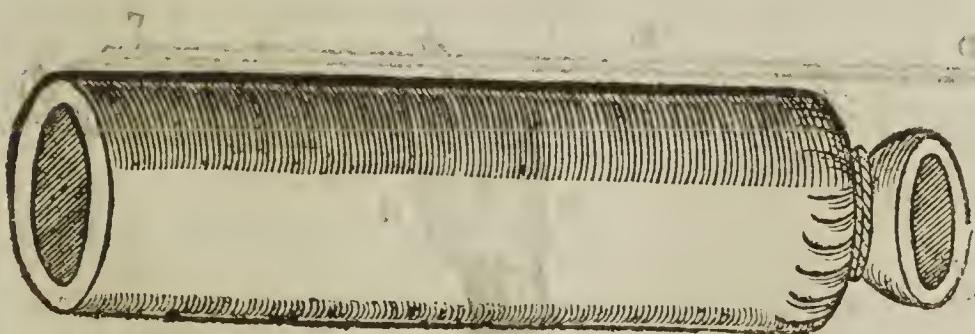
The next Figure marked with M N, doth expresse both the parts of the Former pinned together ; unto this Former there must be made one Rouler expressed by the Figure A ; also two Raminers expressed by the Figures G, and H ; they must all of them be turned very even and smooth ; let the diameter of the thicknesse of the Rouler expressed by the line on the top marked I I, be three quarters of an inch, let it be eight inches long from I to 2, and have a hole bored in the very midst of the end, so wide and so deep, that all the broach of the Former may enter the same : this is to roul the Coffin of paper upon. The first Rammer noted with the Figure G, must be seven inches and a halfe long, from 3 to 4, and have a hole at the end of it, as the Rouler had ; this Rammer is to ram the com-



position into the Former (having the Coffin in it) untill it be rayfed above the broach. The second Rammer noted with the figure H; must be five inches and three quarters long from 5 to 6 and it must have no hole at the top as the other had ; it serveth to ram the composition into the Coffin, when it is once rayfed above the broach. The diameter of the thicknesse of these two Rammers must be a thought lesse than the diameter of the Rouler, to the end they may not hurt the Coffin, being driven in.

Now to make the Coffins you must take paper, parchment, or strong Canvass, roul it hard upon the Rouler, so often untill it will go stiffe into the body of the Former : then thrust it Rouler and all thorow the sayd hollow body of the Former ; put then the broach of the Formers breech into the hole of the Rouler, and with a peece of strong packthred choak the Coffin within halfe an inch of the Roulers end (which you may do best, and with most ease; if you first dip the end of the Coffin into fayr water, so that it may be wet quite thorow) after you have choaked the coffin, you must thrust the breech of the Former, the Coffin also with the Rouler in it, up into the body of the Former : then pin the breech fast to the body of the Former with the pin, and on the Rouler give one stroak or two with a Mallet lightly, then unpin the breech, and with the Rouler thrust the Coffin out of the bottom of the Former; lay it by untill the end be throughly dry.

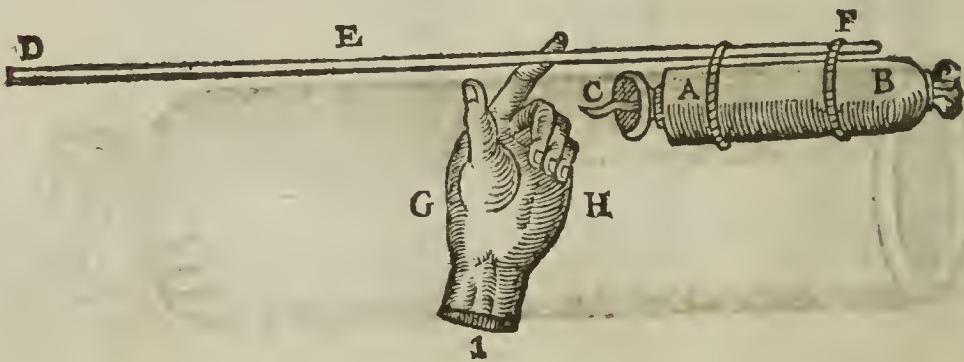
Thus you may at leisure times make divers Coffins ready to use upon any occasion. The following figure expresseth an empty Coffin.



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Take one of these Coffins; put it into the Former, and take the Composition for middle siz'd Rockets (mentioned before) and put thereof spoonfull after spoonfull, untill you have filled the Coffin unto the top of the Former, after the putting of every second spoonfull into the Coffin, with a Mallet give two or three blowes upon the head of the Rammer, that the Composition may be well rammed into the Coffin: every third or fourth driving M. Norton wisheth (if the Rockets are to be fired in three or four dayes) to dip the Rammer in Gum-dragant, and Camphir dissolved in spirit of wine, or good *aqua vita*: but if it will be a month before they will be fired, then dip the Rammer in oyl of peter. If you would have the Rocket to give a report or blow, then within one diameter of the top, drive a bottcm of leather, or six or eight double of paper; peirce and prime eyther of them thorow in three or four places, and fill the rest of the Coffin with whole Gunpowder; afterwards drive another bottom of Leather, and then with strong pack-thred choak the Coffin close unto it: then take the Rocket out of the Former, and prime it at the broach-hole with a peice of prepared Stouple, bind unto it a straight rod 6 or 7 times the length of the Rocket, and so heavy that being put on your finger, it may ballast the Rocket within two or three diameters of the same: mark the following Figure, which represents a Rocket ready made and finished; A B, the Rocket, C the Stouple that primeth it, D E F the rod bound unto the Rocket with two strings; G H I, the hand that poyseth it.



How to make Serpents.

The Coffins for Serpents are made of paper rouled nine or ten times upon a Rouler not much thicker then a goose quill, and about four inches long. The Coffins must bee choaked almost in the midst, but so that there may be a little hole, thorow which one may see: the longest part of the Coffins for Serpents must be filled with the composition specified before: if you would have it wamble in the Ayer, then choak it not after the composition; but if you would have it not wamble, then half-choak it, as is demonstrated by the following Figure: the shorter end of the Coffin must be filled with whole Gun-pouder, and choaked quite up, as appeareth at B, in the Figure M N O, which is the Figure of a Serpent ready made.

*How to make Raining Fire.*

Take divers Goose quills, and cut off the hollow ends of them, and fill them with the composition before mentioned, stopping them afterwards with a little wet Gun-pouder, that the dry compositions may not fall out.

How to make Stars.

I have sufficiently taught the making of these in describing their compositions, wherefore I will now onely present the Figures of them unto your view; A A, signifieth two that are bound up in Paper or Cloth, and pierced, and primed with Stouple: the other two, E E, signifie those that are made up without Paper, and need no priming more than the pouder of Sulphur dust that they are rouled in.

*How to make Petards.*

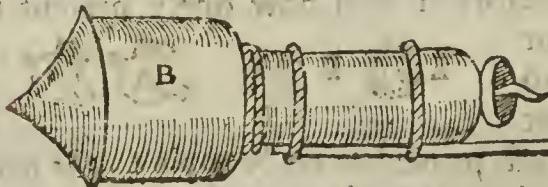
You must make the Coffins of them either of white Iron, or else of Paper, or Parchment rouled upon a Former for the purpose,

purpose, and after fitted with a Cover, which must be gleued on : these Coffins must be filled with whole Gun-pouder, and pierced in the midst of the broad end, and primed thereat with prepared Stouple ; the Paper ones must be covered all over with Gleu, and the pierced. The Figure of a Petard ready made, and primed, is signified by the Figure E.



How to make compounded Rockets.

First, you must make the Rocket I taught you before; you must not choak the end of it, but either double down half the Coffin, and with the Rammer and Mallet, give it one or two good blows ; then with a Bodkin pierce the Paper unto the composition, or else drive a bottom of Leather fitted unto the bore of the Rocket, and pierce it thorow into two or three places ; then pare or cut off the Coffin equal thereunto ; to this end of the Rocket you must binde a Coffin wider a great deal than the Rocket is ; strew into it a little Gun-pouder dust, that it may cover the bottom of this Coffin, and put therein with their mouths downward either Golden Rain, or Serpents, or both ; also Stars or Petards : you must put some Gun-pouder dust among these ; when you have filled the Coffin with these or such like, cover the top of it with a piece of Paper, and paste upon that a picked crowned Paper, ballast it with a Rod, and it is finished ; the Figure followeth.



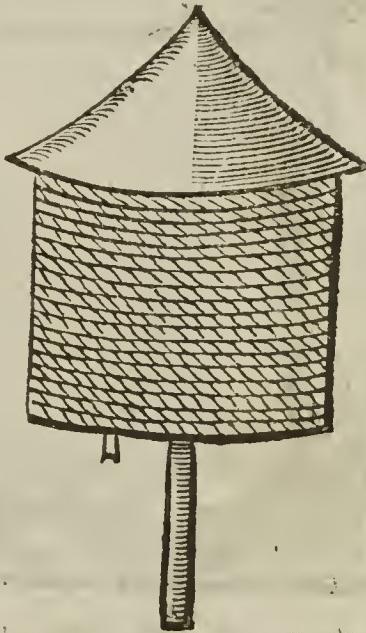
Hom

How to make Fiends, or fearfull Apparicions.

These must be made of the compositions for Stars, wrought upon Cotton-wiek dipped in *Aqua vite*, wherein Camphire hath been dissolved, and after what fashions your fancy doth most affect.

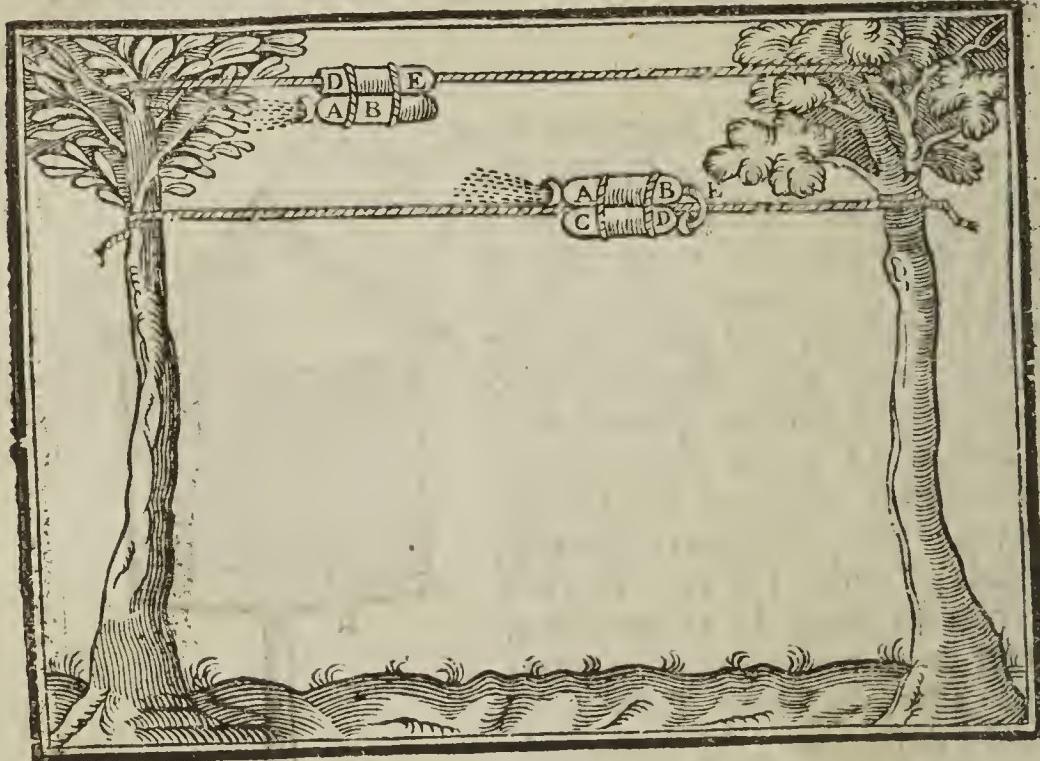
How to make Fier Boxes.

You must make the Coffins for Fier Boxes of Pasteboard, rouled upon a Former, of what bigness you list; then binde them about with Packthred, and gleu over the Cords; also gleu Bottoms unto them, which must be pierced with a Bodkin to prime them at. In these Boxes you may put Golden Rayn, Stars, Serpents, Petards, Fiends, Devils. The tops of these Fier Boxes must be covered with Paper as the compound Rockets. Note that you must strew Gunpowder dust a pretty thickness on the bottom of the Fire Boxes, and prime the hole at the bottom with prepared Stouple.

*How to make Smevels.*

SMevels are nothing else but Rockets, having in stead of a Rod (to ballast them) a little Kane bound fast unto them, where thorow the Rope passeth. Note that you must be careful to have your Line strong, even and smooth, and it must be rubb'd over with Sope that it may not burn. If you would have your Rockets to return again, then binde two Rockets together, with the breech of one towards the mouth of the other, and let the Stouple that primeth the one, enter the breech of the other; both kindes are expressed by the Figures; the uppermost

most whereof representeth the single one; A B signifieth the Rocket; D E the Kane bound unto it, thorow which a Rope passeth. The lowermost representeth the double Rocket;

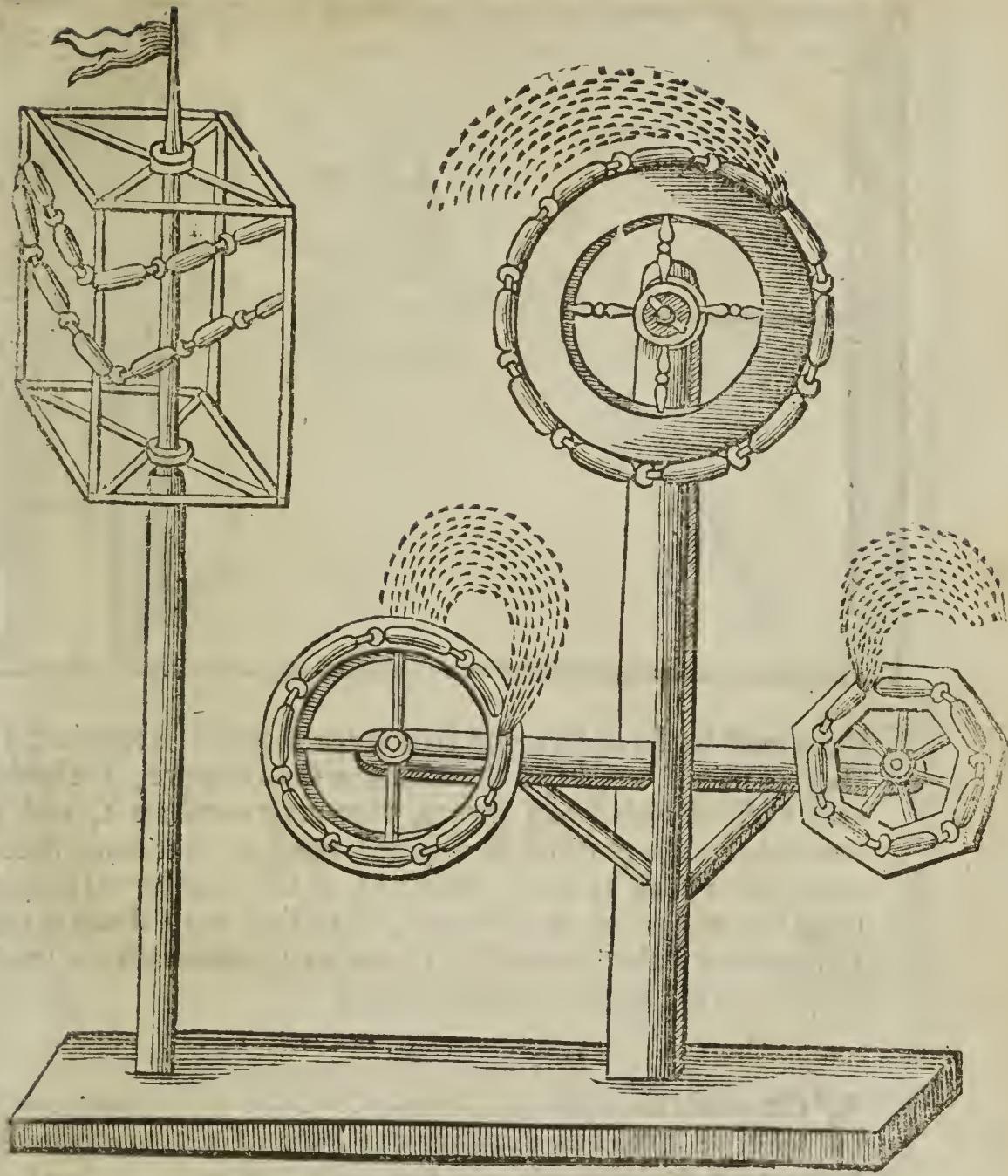


A B signifieth one Rocket, and C D another, E the Stouple that primeth the one, and entreth the breech of the other; the Cane that the Rope passeth thorow is supposed to be behinde the two Rockets.

How to make Gironels, or Fier-wheels.

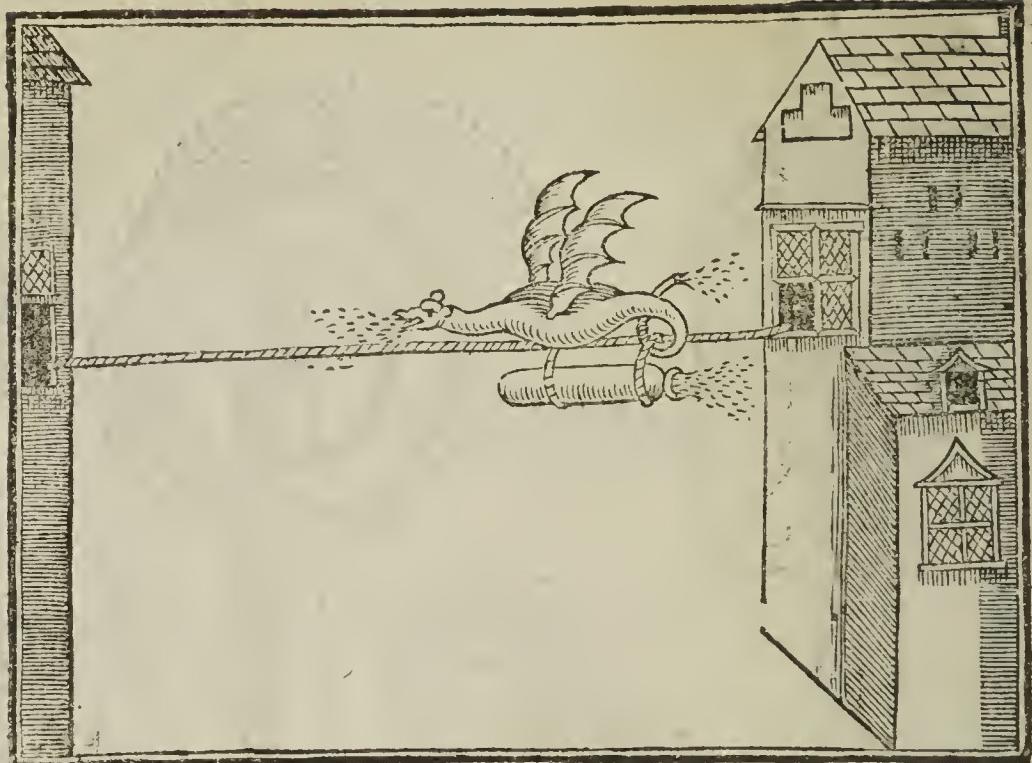
The making of Fier-wheels consisteth onely in the placing of Rockets, with the mouth of one towards the tail of another, round about certain moveable Whels; wherefore I think it sufficient onely to describe the diversity of their fashions.

How .



How to make flying Dragons.

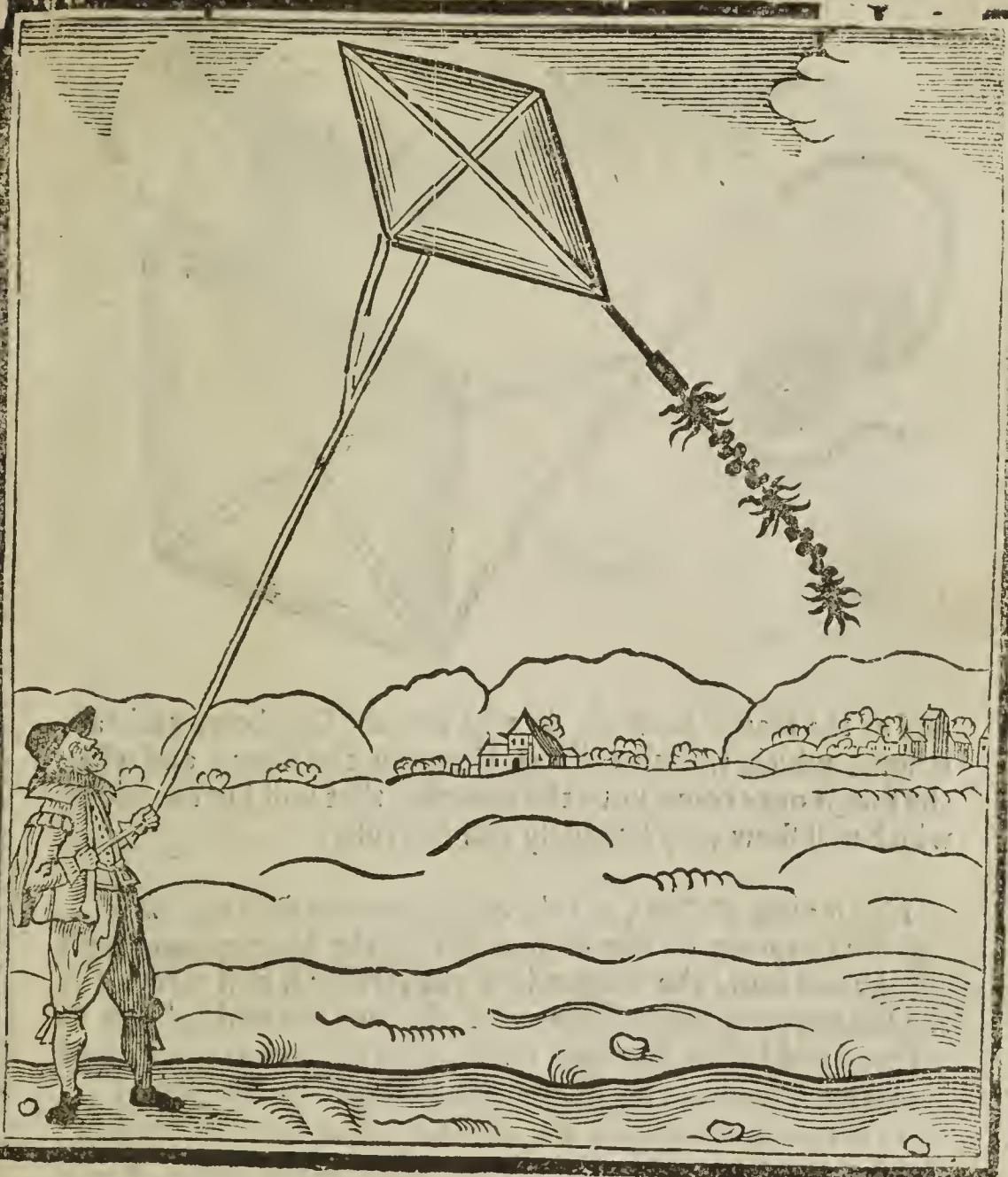
The flying Dragon is somewhat troublsom to compose; it must be made either of dry and light wood or *Crooked-Lane Plates*, or of thin Whale-bones covered with *Muscovy Glas*, and painted over. In the body thereof, there must be a void Kane to pass the Rope thorow; unt the bottom of this



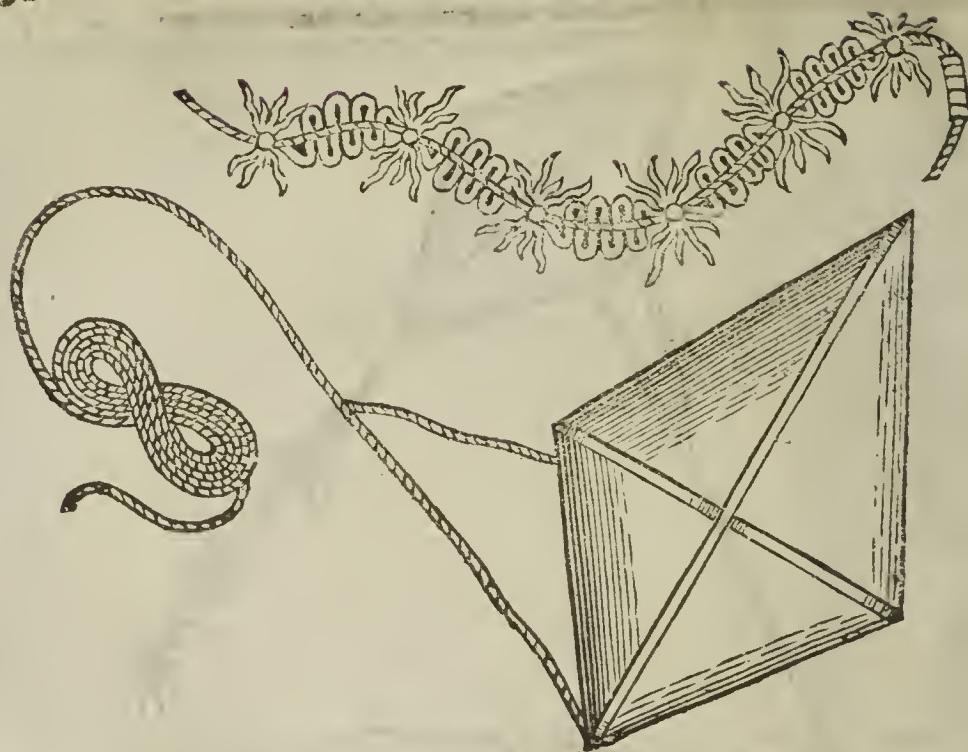
Kane must be bound one or two large Rockets, according as the bigness and weight of the Dragon shall require; the body must be filled with divers Petars, that may consume it, and a sparkling receipt must be so disposed upon it, that being fired, it may burn both at the mouth and at the tail thereof; then hang the wings on in such wise, that they may shake as the Dragon runs along the Line; you may dispose divers small Serpents in the wings; mark the Figure.

How to make Fier Drakes.

YOU must take a piece of Linnen Cloth of a yard or more in length; it must be cut after the form of a pane of Glass; fasten two light sticks cross the same, to make it stand at breadth; then smear it over with Linseed Oyl, and liquid Varnish tempered together, or else wet it with Oyl-of Peter; and unto the longest corner fasten a Match prepared with Salt peter water (as I have taught before) upon which you may fasten divers Crackers, or Saucissons; betwixt every of which binde a knot of Paper-shavings, which will make it fie the



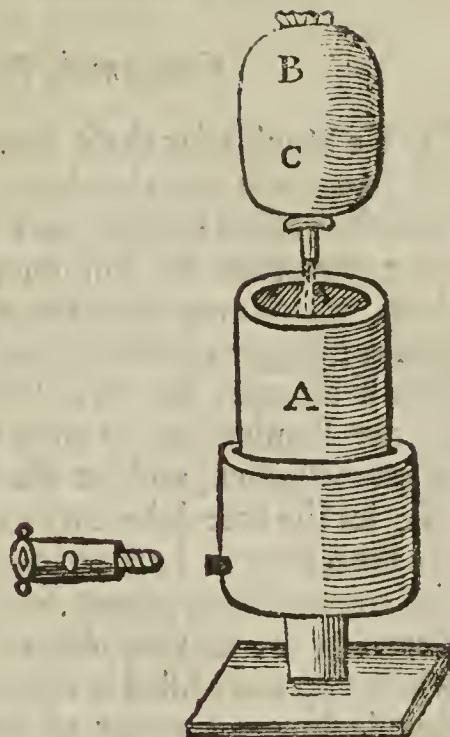
the better ; within a quarter of a yard of the Cloth, let there be bound a piece of prepared Stoupel, the one end whereof, let touch the Cloth, and the other enter into the end of the Saucisson : then tie a small Rope of length sufficient to raise it unto what heighth you shall desire, and to guide it withall : then fire the Match, & raise it against the wind in an open field :



and as the Match burneth, it will fire the Crackers, and Saucissons, which will give divers blows in the Ayer; and when the Fier is once come unto the Stouple, that will fire the Cloth, which will shew very strangely and fearfully.

How to make Balloons, also the Morter-piece to discharge them.

The Diameter of the hollowness of the Morter-piece must be one foot, the longer it is the farther it will carry. Let the Diameter of the hollowness of the Sack be the third part of a foot, and half a foot deep: it must have a square foot, and a Portfire to strew in the bottom of the Sack on the side of it; this Portfire is to be made like a Kane about three inches long, and have a bottom soldered unto the inside of the Skreu, which bottom must be pierced with a small touch-hole. This Morter-piece may be made of Iron, Red Copper, or for a need with Pastboard, armed with Cord, and gleued over, but the Sack and foot of it must be made of Wood, and the Pastboard must be nailed fast upon it. A Balloon must be made of Canvas rouled eight or nine times upon a Former, it must be made so, that it will easily go into the Morter-piece; into this Balloon you may



may put Rockets, Serpents, Stars, Fiends, Petards, and one or two Saucissons to break the Balloon ; then choak it up with Cord, and prime it with a little Kane rammed full of a slow composition ; fill the Stock of the Morter-piece full of whole Gun-pouder, then skrew on the Portfire O, then put the Balloon down to the bottom of the Morter with the Kane that primeth it, downward into the Stock ; then with Tallow or Grease stop the Chinks between the Balloon and the Morter, and it is ready to be discharged, which you may do by putting fire to the Portfire, and while that burneth, retreat out of harms way.

A, the Figure of the Morter-piece with its Portfire. O B C
a Balloon ready made. D, an empty Coffin for a Balloon.

Of Fier-works for the Earth.

How to make Rockets for the Earth.

The Moulds for these Rockets for the Earth are not made like those for the Ayer, because that it is required that these should last longer, and have a more gentle motion: observe therefore the following Directions for the making of them, which may serve for all occasions, without any alteration for bigger or lesser. Let the diameter of their hollowness be half an inch, let their hollowness be five or six inches long, let the Rouler, for to roul the Coffins on, be the third part of an inch thick, and let the Rammer to charge it be a thought less, let the breech be three quarters of an inch long, and let the breech enter half an inch into the Mould, then fill it with the composition proper for it, observing those Rules in the ramming it, as you did in ramming Rockets for the Ayer; when you have filled it within an inch of the top of the Mould, double down a quarter of the Coffin, beating it with three or four strokes of the Mallet; then with a Bodkin pierce it in two or three places, and then put in the quantity of a Pistol charge of whole Gun-pouder, then double down the half of the Coffin, giving it a gentle blow or two with the Mallet, and with a strong packthred choak the rest of the Coffin, and what remaineth after the Coffin is choaked, cut it off, and it is made.

How to make Crackers.

It is well known that every Boy can make these, therefore I think it will be but labour lost, to bestow time to describe their making: onely thus much, if you would make a Cracker to give forty, fifty, a hundred, or two hundred blows, one after another, then binde so many Crackers upon a Stick, so that the end of the one may joyn to the mouth of the other.

How to make Trunks.

These you may make of Pasteboard, Paper, or Wood, and of what bigness and length you please, and ram them full of the composition of Rockets for the Earth; if you would have them

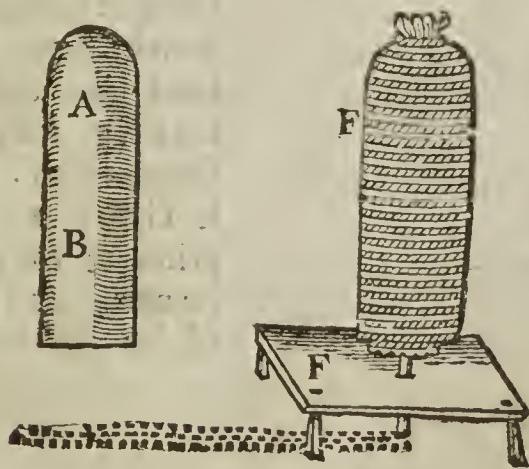
them to change colour, then alter the composition ; that is, put in 2 or 3 spoonfuls of the composition of Rockets for the water, and ram that in, then put in two or three spoonfuls of the composition of Rockets for the Ayer, and ram that in, then put in two or three spoonfuls of Gun-pouder dust, and ram that in, do so till you have quite filled it, then tie a bottom of Leather upon it, and pierce it, and prime it with Stouple. After the same manner may you make Lanterns and Lights.

How to make Tumbling Balls.

Make a Ball of Canvas, and fasten in it a double Rocket for the Earth ; you may stuff the rest of the Ball with a slow composition of two parts Charcoal dust, and one part of Gun-pouder dust, mingled together, and put divers Petards amongst it.

How to make Saucissons.

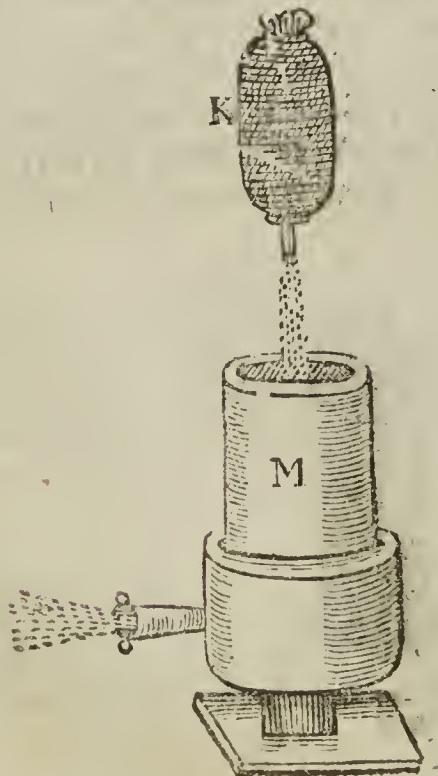
Saucissons are of two sorts, either to be placed upon a frame, or such like, and so to be discharged with a Train of Gun-pouder, or else to be discharged out of the Morter-piece. The standing Saucisson is thus made ; you must roul Paper or Canvas, nine or ten times upon a Rouler as A B, and choak the one end of it ; fill it then with whole Gun-pouder, and then choak the other end also, then cover all the Saucisson with cord, and gleu it over ; then pierce one end of it, and prime it with a Quill filled with Gun-pouder dust ; place it upon a Frame having a Hole for the Quill to pass thorou ; then fire it by a Train of Gun-pouder laid under the Frame, it will give a Report like a Canon : Mark the Figure F F.



FIER-WORKS.

How to make Chambers.

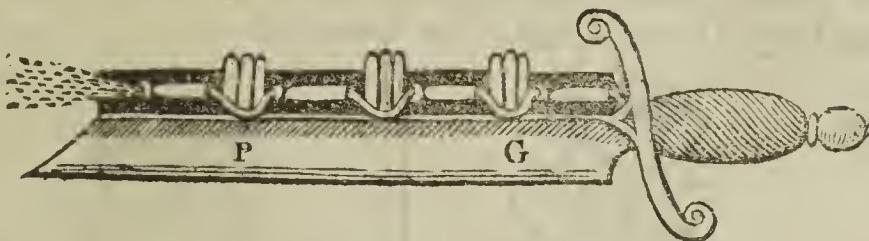
TAKE a Rocket Case of what size you shall think fitting, according to the report you would have it give; choak one end of it close, and put it into a Former without a broach, then fill it one inch and a halfe or more (as you think fit) with whole Gunpouder, and drive a bottom of leather hard into it; this bottom of leather must be pierced with a small hole in the middle, with a hot yron, or else it will bee apt to close again. Fill then the other part of the Coffin with a slow compocision, up to the top, then take it out and binde 6 or 7 times about it a strong pack-thred in that place where the bottom of leather is, and it is made: you may binde divers of these on a row upon a Frame, Rayl, or such like, and then put fier to their open ends, and they will burn slowly untill they come to the bottom of leather, and then each will give a report or blow one after another orderly as you gave fier unto them. And these are usually called Chambers, but more properly Saucissions.

How to make the flying Saucisson to be delivered out of the Morter-peece.

MAKE a Coffin for this, as you did for the former; first fill it almost full with whol Gunpouder, then put upon it Gunpouder dust, which you must ram hard into the Coffin, so that it may bee one finger thick: then choak it close, and arm and prime it as you did the former. It is represented by the Figure K M.

How to make a Fier-Sword.

You must make a Sword of Wood, having a deep channel in the back of it, wherein place first a Rocket for the ground ; then two or three Serpents upright ; (with their mouthes inward) let the stouple that primeth the Rocket, come under the mouth of the Serpent, so that being tinded, it may set them on fier, and enter the breech

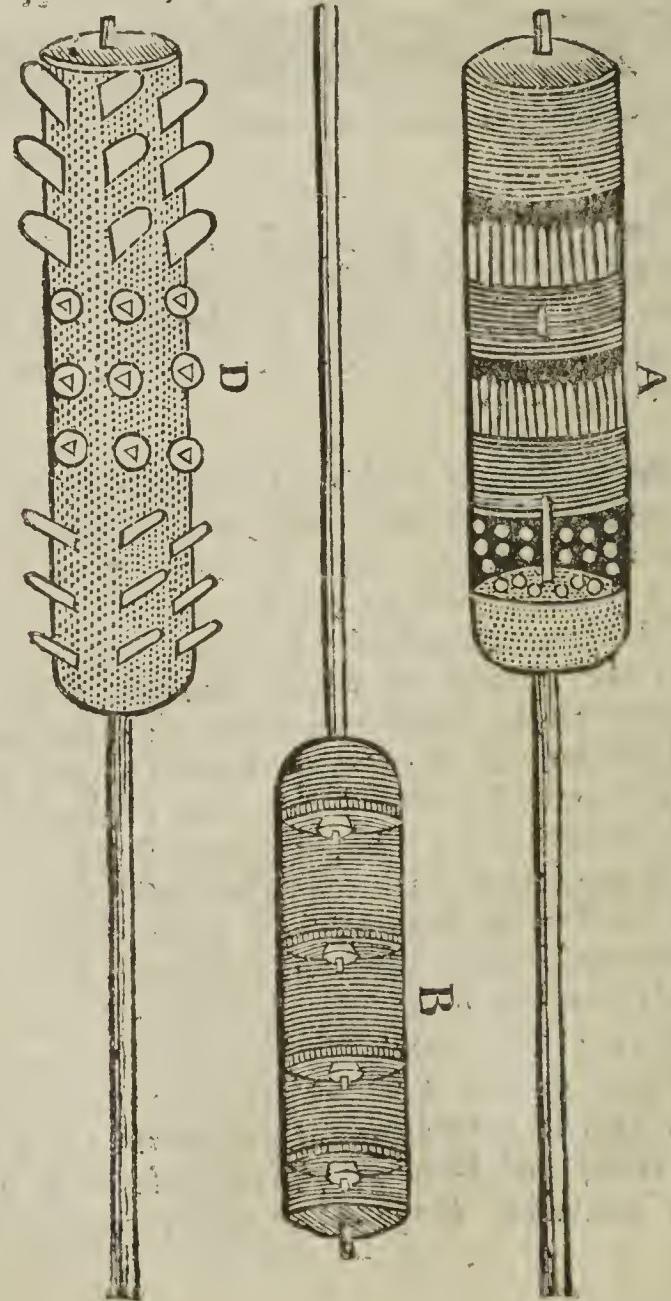


of the next Rocket, so fill the channell quite full with Rockets and Serpents: binde the Rockets fast into the channell, but the Serpents must be placed so, that being once fired, they may fly out of the channell, and it is made : mark the Figure G P.

The Description and making of three sorts of Fier-Lances.

To make the first Fier-Lance, whose Figure is noted A, you must make a hollow Trunk of what length or bignesse you please, eyther of wood, paper, or pastebord rouled on a Rouler, and armed with some cord and gleu ; first put into the bottom of whole Gunpowder about one or two fingers thick, then ram upon it a pastebord pierced with a little hole in the middle, having a quill fastned in it, which quill must be filled with a slow composition, or else with Gunpowder dust : this quill must stand up in the Lance two or three inches ; then fill the Coffin up to the top of the said quill with Starres, and streu among the Starres some Gunpowder dust, then put pastebord over them, having a hole for the quill fastned in the former bottom of pastebord to passe ; then upon this pastebord ram Gunpowder dust one or two fingers thick, then put a row of Serpents in, and in the midst of the Serpents put a kane open at both ends, and filled with Gunpowder dust ; this kane must bee somewhat longer than the Serpents, and it must

passe thorow a pastebord¹, which must be put over : then put some more Gunpouder dust, and ram it in upon it, and upon that put another row of Serpents, with a kane in the midst of them filled with a slow composition, and upon them put Gunpouder dust, or else a slow composition, ramming it in till the Lance be full ; then put a pastebord upon it, and in the midst of the pastebord put a little kane filled with a slow composition, then fasten it upon a staffe of what length you will, and it is made.



To make the second Fier-Lance, you must prepare a Trunk like unto the former, first ram in the bottom of it some of the composition of Rockets for the Earth about two fingers thick, then put a pastebord upon it, having a petard fastened in the middest ; this pastebord must be pierced in three or four places, round about the petard, that thereby the pouder that is rammed over the pastebord may take fier ; then ram in some more composition upon the petard, about two or three fingers thick, then another petard, then more composition, so doing untill you have filled the Trunk : then fasten it upon a stiffe; and prime it as you did the former, it is represented by the Figure noted B.

To make the third Fier-Lance you must have a Trunk also, which must be rammed full of a slow composition, of two parts charcoal dust, and one part Gunpouder dust well mixed, prime it as the former, then bore divers holes round about it, from the top to the bottom, into every of which holes gleu a Saucisson, or a Serpent, or a little ball filled with Gunpouder dust, and having a petard in the middle : eyther of these must be well primed, and their primed ends must be towards the inside of the Lance, so that as the Lance burneth downward, it may orderly give fier unto the Saucissons, Bals, and Serpents : the Figure D representeth a Lance having three rowes of Serpents, three rowes of Bals, and three rowes of Saucissons, fastned round about it.

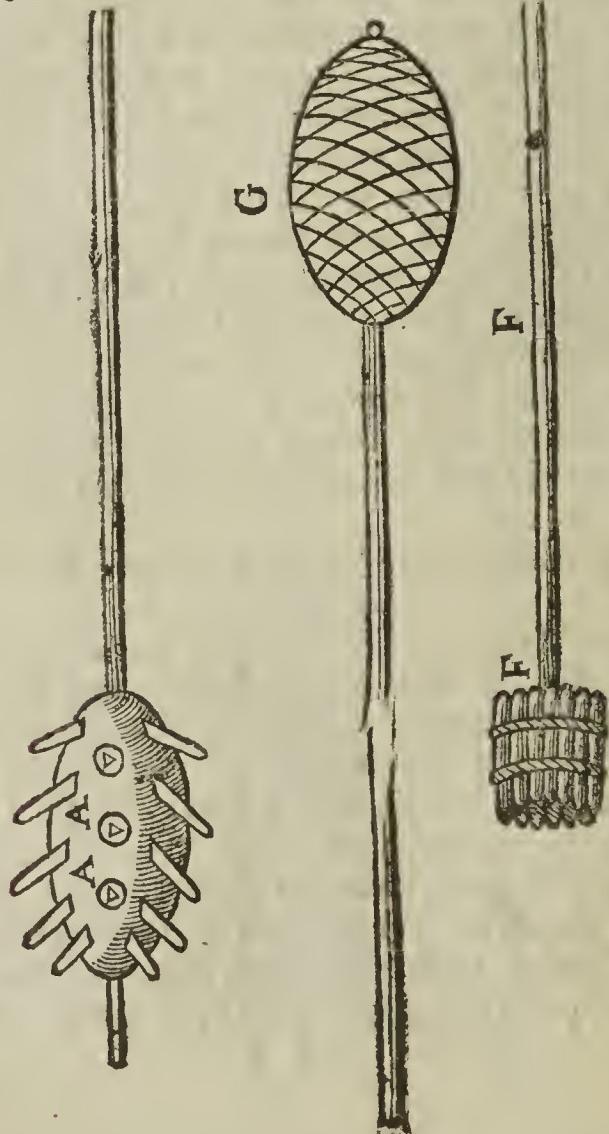
*How to make another Trunk with some Pretty Motion
upon the top of it.*

You must prepare a Trunk like unto the former, and fill it with a slow composition, and fasten a square boord upon the top of it, with a hole cut quite thorow it, answerable to the hollownesse of the Trunk ; upon this boord you may hang a wheel made of light stiffe, having divers catches of wood or white Tin, like unto the wheel of a Water-Mill, which catches place reaching halfe over the mouth of the sayd Trunk, so the Trunk being fired either by a match or a train of pouder, the very force of the fier and smoak proceeding out of the Trunk, will cause the

wheel to turn round. You may make also another wheel with poppets round the top, and so place it that it may receive mocion from the former mencioned wheel ; or instead of placing a wheel or wheeles upon the top you may fasten divers poppets made with joynts after such a Device that they may seem to fight and combate one with another, by the force of the fired Trunk.

The Descripcion and making of two sorts of Fier-Clubs.

TO make the first, you must make an oval Ball of pastboord, canvasse, or parchment gleued together, which you must first fill with a slow composition, ram it in, and then bore divers holes round about it, and put therein Ser-



FIER-WORKS.

III

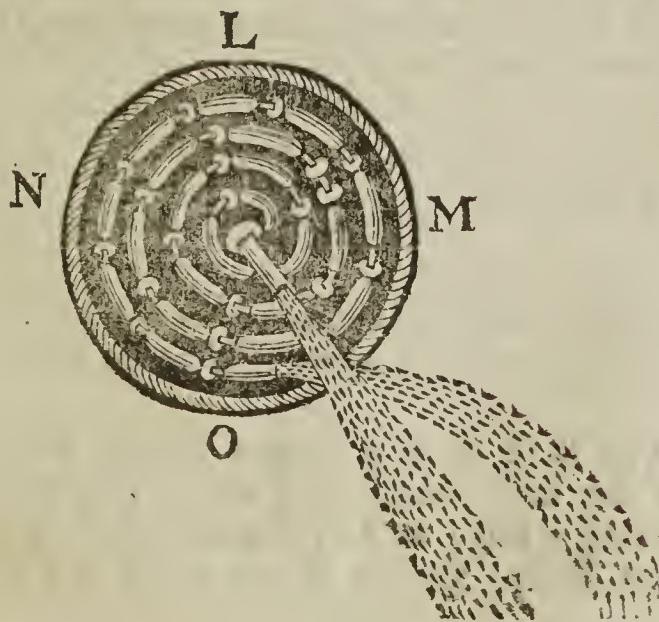
pents, fier-Bals, or what you will : fasten it upon a staffe, and prime it in the top with a kane filled with a slou composition : this is represented by the Figure A A.

To make the second, you must fill divers kanes open at both ends (and of a foot long, or more, or less, as you think fit) with a slou composition, and binde them upon a staffe of foure or five foot long ; prime them so that one being ended, another may begin ; you may prime them with a stouple or match (prepared as before) then make an Osier Basket about it with a hole in the very top to fier it by, and it is done.

The Figure F F, representeth the staffe, with the kanes bound upon it. The Figure marked G representeth the staffe having a Basket wrought over it.

How to make a Fier Target.

Make a Target of Osier twigs or else of light wood, and binde upon it divers kanes filled with a very slow composition : the kanes must be open at both ends, and primed with stouple, that one may give fier unto another : in the midst of all you may set up a large kane also, if you please, which you may fill with the same composition as you did the other. Mark the Figure L M N O.



O F F i e r - w o r k s f o r t h e W a t e r .

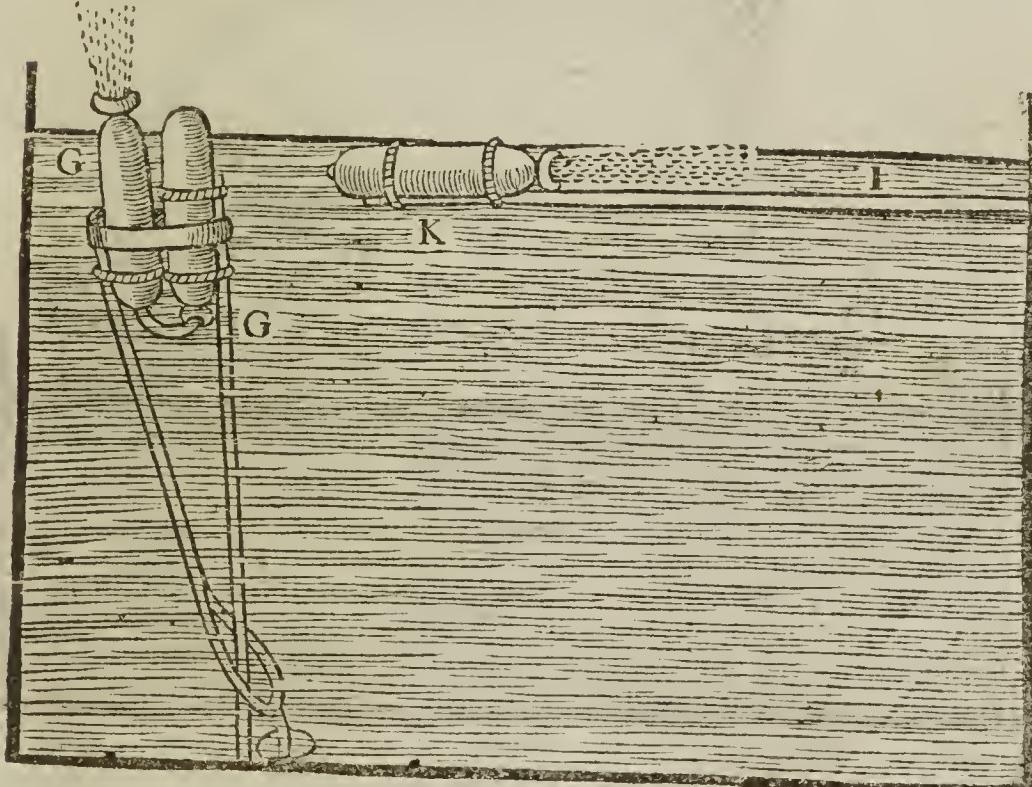
H o w t o m a k e R o c k e t s f o r t h e W a t e r .

THe diameter of the hollownesse of the Mould for Rock-
ets that swim on the water, must be one inch, and eight
inches long : let the breech enter into the body of the
Rocket one inch, and it must have no broach at all in it.
Let the diameter of the thicknesse of the Rouler bee three
quarters of an inch, the Rammer must be a thought lesser :
then ram it full of the composition of Rockets for the wa-
ter ; joyn to the upper end of it a Saucisson : then cover
it all over with melted Pitch, Rozin, Wax, or Tallow, to
the end that the water may not spoyl the Coffins ; and to
make it float along the water, binde a rod about two foot
long, as you did unto the Rockets for the Ayer : now if
you would have the Rocket to change his actions, (that is
to swim one while above the water, and one while under
the water) then put into it in the filling, one spoonfull of
composition, and ram that in ; then one spoonfull of whole
pouder, and ram that in ; and then another of composition,
and after that another of whole Gunpowder : so doe until
you have filled it quite. If you would have it change co-
lour, then shift the composition divers times, (that is, put
in one spoonfull of the composition of Rockets for the wa-
ter, then another spoonfull of the composition of Rockets
for the Ayer, or Rochpeter and Gunpowder mixed) until
you have filled it.

*H o w t o m a k e a R o c k e t t h a t s h a l l b u r n a g o o d w h i l e i n t h e W a-
t e r , a n d t h e n m o u n t u p i n t o t h e A y e r .*

First, you shall make a Rocket for the water, and binde
unto the lower end a stick about two foot and a halfe
long, having a large hole in the end thereof : then tie un-
to it (but loosly, so that it may easily slip out) a Rocket
for

for the Ayer, and let the stouple that doth prime the Rocket, for the Ayer, enter into the breech of the water Rrocket, then let the end of the rod of the Rocket for the Ayer enter into the hole of the rod of the Rocket for the water ; besmeare then both the Rockets with tallow, grease, or wax, or any oyl colour, that the water may not spoyl the coffins of the Rockets ; then hang a stone at the bottom of the stick that hath the hole in it to make it sink down into the water ; then fier the wa-
ter Rocket and cast them into the water ; the fired Rocket will burn in the water, and being consumed, will give fier unto the other Rocket, which being loosly tyed, will slip the bond, and mount up into the Ayer. This is represented by the Figure G G. The floating Rocket mentioned be-
fore, is expressed by the Figure noted I K.

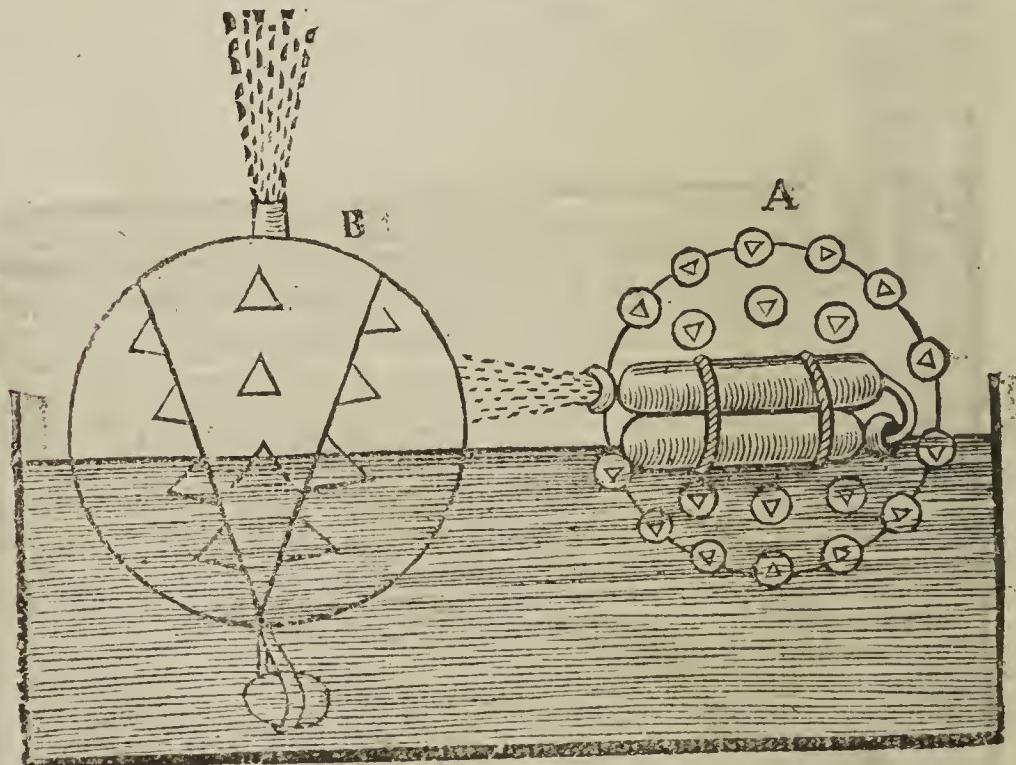


Q

The

*The Description and making of two sorts of
Fier-Bals for the water.*

For to make the first, you must make a Ball of Canvas, about the bignesse of a Foot-ball, or bigger if you please, and fasten in it a double Rocket for the water : if you will, also you may stufte the rest of the Ball with the composition that will burn under the water, and cut holes in the sides, and therein fasten other Bals, and petards in them : then cover the Ball over with Tallow, Pitch, or painting, except the place where the Rocket is primed, and it is done. It is represented by the Figure noted with A, and it will tumble up and down in the water.

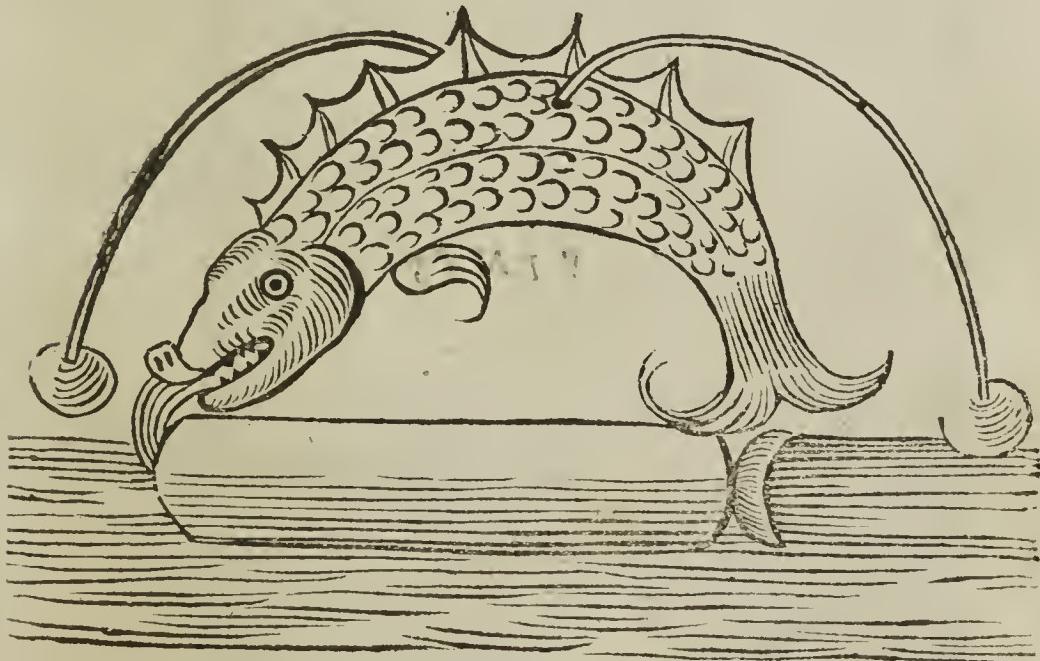


To make the second Fier-Ball, you must first make a Ball of Canvas, Pasteboord, or such like, and cut a wide hole in the top of it, and place it in a channell of Tinne pierced

pierced in divers places : fill the channell with the compositions of Rockets for the water ; against every hole thereof, place a petard : cover it with a Cover, Pitch it over, and prime it, then ballast it with Lead, or a stone, that the vent may burn upwards, and it is done. It is represented by the Figure B,

How to make a Dolphin.

You must make the body of it of Pasteboord gleued together, fill the body with the composition of Rockets for the water, pierce it in the back with divers little holes, wherein put Serpents, besmear the body all over with the following Pap. Take Gunpouder dust, four ounces, Cam-



phir, and Sulphur, or Brimstone in pouder, of each one ounce, make them into a soft pap with oyl of Tiles, then binde unto it a large Rocket for the Water, which Rocket must be armed (as afore) that the water may not hurt it, then fasten it unto a peece of wood or cork cut like a sharp

Q 2

boat,

FIER-WORKS.

boat, or ballast it with a wyer, having at each end a piece of Lead of weight sufficient, and it is done. Mark the Figure. After the same manner you may make Mermayds and other delightfull representacions.

I might have beene infinite in the describing of such like with Ships, Towers, Castles, Pyramids. But considering that it would but increase the price of the Book, and not better your understanding : since all consist of the former works, which are so plainly described, as that the most ignorant may easily conceive thereof, and (if any whit ingenious) thence contrive others, of what fashion they list.

FINIS

The Excellent Arts and Sciences
OF
Drawing, Colouring, Limming,
Paynting, Graving, and Etching,

Plainly and accuratly demonstrated

By JOHN BATE.



L O N D O N,
Printed by R: Bishop for Andrew Crook, at the Green
Dragon in Pauls Churchyard. 1654

To the Reader.

The Art of Drawing is in it selfe most Excellent, and worthy of commendacions in whomsoever it is : yea it is an Art so necessary unto all ingenuous Artists, as that they can in no wise be without it. My selfe have often known it true, that the sight of a good Figure is more unto an ingenuous person, then a whole Chapter of information : wherefore I have according unto my Knowledg and practice in the same, faithfully penned it; for such as bear affection unto the Art, and are desirous to be informed therein, adding thereunto such instructions as I have received from such Professors as I have had familiarity with ; also other Collections that I have gathered from time to time out of such as have written of this Subject. And for divers persons that cannot attain unto it, or are loth perhaps to bestow any time to practise it, whereby they might come to a requisit perfection ; for such I have set down certain Directions, and those so facil and easie, that persons altogether unskilfull may (having a pattern) work very well thereby.

First, I will speak of Drawing in generall.
Secondly, of washing or colouring Maps and other Pictures.
Thirdly, of Limming.
Fouribly, of Painting in Oyl upon Cloth or Boord, and of Distempering.
Fifthly, of Painting upon Glasse, and Annealing.
Sixthly and lastly, of Graving and Etching.

Farewell.



Of Drawing

Drawing is an Imitacion or lively Representacion of things, according unto their likeness and similitude : It is performed with the Pen or with Pastils. In one that would bee accounted absolute and eminent in this most Excellent Science, there is required ; First, a good affection or love thereunto : Secondly, that he have some knowledge in *Naturall Philosophy* : Thirdly, a copious and plentifull invencion. From the two first, he himselfe shall receive wonderfull delight and contentment in his practising : and the last, will make his work pleasing, and to be desired of others.

Of necessary Implements, or Instruments for Drawing.

First, he must provide store of drawing pens made of Ravens quils, good thick and smooth paper : also light coloured bleu paper, and fine parchment, a flat thin brasse Ruler, and a payr of Compasses : also a Wing, and sundry Plummets or Pastils to draw with all.

Of Plummets or Pastils.

Plummets or Pastils are of to sorts ; the one wee may call naturall, because they are such as of themselves being pointed, are made meet or fitting to draw withall : such are these ; Black Lead, Black chalk, Charcoal split, Red stone, white Chalk.

Others there are which we call artificiall, because they are made by tempering ground colours artificially, and after forming them into little roules, meet and convenient to draw withall.

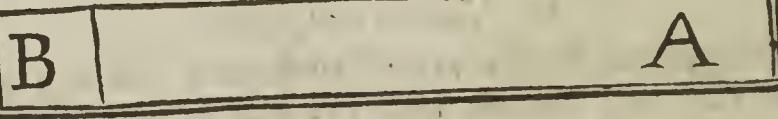
*The manner of making artificiall Pastils or Plum-
mets to Draw withall.*

TAKE a great Chalk-stone, and make furrowes or cavities in it two or three inches long, and so wide that you may lay into each a quill. Then take a proporcion of white chalk ground very fine, temper it with Ale or Wort, and a little new Milk, and so make Pap thereof : then pour it into the furrowes of the chalk : soon and in a short time, you may take them out and roul them up, or let them lie in the same untill they are quite dry, and then take them out and scrape them into a handsom form.

You may temper Lake with burnt Alabaster for a red. Alabaster burnt and Bice for a bleu, and so for others ; having regard to some colours that will binde over hard, which must have a little water put to them in their grinding.

The practice of Drawing.

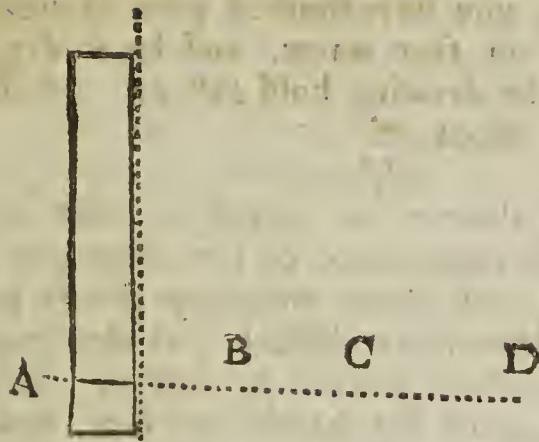
THe first practices of a Beginner, must bee readily and quickly to Draw with his Pen, Cirkles, Ovals, Squares, Pyramids, Paralels, Diameters, and other Geometricall solid bodyes, for these will fit his hand for the performance of other bodyes : and unto these and such like, he may reduce all other works whatsoever. You may in the beginning assist your selfe in the performance of these : as also try whether your operacion be done aright, by your Ruler and Compasse. Let the end of your Ruler bee marked with a crosse stroak athwart it. The Figure of the Ruler followeth, and it is noted with the Letters B A, it will help you to Draw Squares, Diameters, Paralels.



Example.

Let A B C D be a Line given, whereon to erect another Line that they may both stand square ; Lay but the Ruler so that the crosse at the end of it, may be full upon the Line, then Draw a Line by the side of the Ruler, and it is done. Observe the Figure following.

Your



Your Compasses will serve to mark your distances aright, and to assist you in describing Cirkles and Ovals : these I say may assist you, but you must endeavour to attain to the performance of the same, without the help of these. Next, let him practice to Draw Pots, Balls, Candlesticks, Pillers, Houses, and other such like Figures, that come nearest unto the former. Then to Draw Leaves, Flowers, Slips, Flyes, and Creeping things ; and Lastly (because it is the most difficult to Draw Men) four-footed Beasts, and other such difficult works.

Of the manner of Pourtraiting or Drawing with the Pen.

Let the thing whose pourtraiture you intend to take, stand before you, so thar the light be not hindred from falling upon it, and with a pointed piece of Charcoal Draw it rudely and lightly ; which when you have done, consider a while whether all the parts thereof are proporcionable, and whether it carry the semblance of the thing whence you drew it from ; which if it doe not, wipe it out with your Wing, and begin anew. But if it bee faulty in one part only, wipe out that part only, and Draw it again ; whensoever it liketh you, or that you have so drawn it, that you can finde no great fault in it, wipe it over gently with your wing, so that you may perceive your former stroakes ; then with your black Chalk or other Pastils, Draw it as perfectly and as curiously as you can, and shadow it accord-

R
ing

ing as the light falleth upon it. If you Draw upon bleu paper, after that you have finished your draught, you must wet your paper in fayr water, and let it dry of it selfe, this will make the drawing hold fast on; which other wise woulde easily be wiped off.

Observacions.

1 Endeavour alwayes to retain in your imaginacion, the very Idæa or resemblance of the thing you Draw.

2 When you can Draw ordinary things pretty well, then assay to Draw more difficult; as the proporcions of Mankind, and in them proceed by degrees: first, learn to Draw the head, then the hands and feet, and lastly, the other shape of the body, proporcionable thereunto.

3 Be not out of conceit with your works, although they give you not at the first contentment according unto your minde, for daily practice with a continued resolucion and intencion of the minde, must gayn the true proporcion by little and little.

Of Drapery, or drawing Apparell and Cloaths.

Drapery consisteth in the drawing or figuring of cloth, and garments, with their doublings and foldings shadowed accordingly.

The Rules for Draperie.

1 First, you must Draw the utmost lines of your garments, leaving spare places, where there is need of foldings.

2 Draw alwayes your greater folds first, which continu throughout the whole garment, from the skirt upward, and be sure that you let no one touch or crosse another.

3 Break your greater folds into lesse, not sparing to shadow them, though they be never so small, and that with a double or treble hatch, if so bee that they fall inward and from the light.

4 The closer the Garments sit, the narrower you must make the folds.

5 Order your Garments so, that the folds thereof may fall one way according unto the mocion of the ayer.

6 Fold not your Garments where they ought to sit close, and leave the formes of eminences appearing; as of the Breasts, and Legs.

Of Diapering.

Diapering, is a passing or over-running your Work (after it is quite finished) with branches or other work.

The Rules for Diapering.

- 1 If you Diaper upon folds, you must make your Work to break off accordingly.
- 2 You must have a care to continue the same Work throughout the whole Garment.
- 3 You must set the fairest in the most eminent and per-spicious place.
- 4 You must cause your branches to run all upwards, else your Work will be ridiculous.

Of Landskip.

Landskip is the expression of Land by Hills, and Mountains, Rocks, Ruines, Rivers, Valleys, and such like.

The Rules for expressing of Landskip.

- 1 You must make a fayr Horizon, expressing the Heavens more or lesse over-cast with Clouds ; and if you expresse the Sun, make it rising or setting behind some Hill or Mountain, and then let all the light of the Trees, be given thitherward, and your Clouds must be shadowed from the Sunne.
- 2 Never expresse the Moon or Starres, but upon necessity.
- 3 Be very carefull to lessen your bodyes, proporcionable to their distance, expressing them more faintly or fully according as your Eye judgeth of them.

Of Emblem, or Empress Work.

Emblem or Empress work, is the most hard or difficult of all others, and the most to bee commended above all other works : It is to imitate the face of Mankinde so near after the life, as that not only the party in all likenesse both in favour and complexion, but also his best graces and countenance is most notably expresset. This indeed ought not to be attempted untill one were reasonable good in Story work, which you may in a reasonable time attain unto, by the imitation of good prints.

The comeliness of the Face consisteth in three parts,

First, in the fayer and beautifull colour and complexion; Secondly, in the good favour and proporcion. Thirdly in the grace of the countenance. The curious Drawer must watch, and as it were catch the lovely graces, witty smilings, and sullen glances which passe suddenly like lightning, observing how in smiling the Eye changeth, and narroweth, holding the sight just between the lids, as a center ; how the mouth extendereth a little both ends of the line, upwards ; the Cheeke rayse themselves to the Eyes-ward ; the Nostrils play, and are more open ; the veynes in the Temples appear more, the neck commonly erecteth it selfe, the eye browes make straight Arches, and the Forehead casteth it selfe, as it were, into a plain. In like sorte, the countenances of Wrath, Fear, and Sorrow, have their severall alteracions.

The Dawner must make the eyes of his picture so like one another, as Nature doth ; for in the Eye is the life of the picture. Be sure that the circle of the sight be perfectly round, for so much thereof as appeareth ; and the Center truly placed in the midst thereof. The reflection of the sight which appeareth as a white speck, must be placed accordingly unto the light.

The farthest Eye from the Drawer, must be a little higher than the hithermost, because of the prospective, if the Drawer sit any higher than the party drawn ; But if lower, then the farthest eye must be a little lower. If level, then to be of one heighth. So shall the work by well placing and true doing of the Eye have great life ; for of all the Features in the Face of a picture, the eyes give the most life, the Nose the most favour, and the mouth the most likenesse ; although likenesse bee contayned in every part, even Feature in the Cheeke, Chin, Fore-head, with the compasse of the Face, but principally and especiall in the Mouth.

The Drawer must mark when the party removeth, though never so little, if on the suddon he remove a great deal, then he may easily mark it, and recall him unto his first line, but the little moving (if he perceve it not quickly) will lead him into a great Error.

In drawing after the life, sit not nearer than two yards from off the party, and sit as even of one heighth as possibly.

bly you may, but if the party you draw, be a very tall person, let him sit a little above you, because men are commonly under him, and will not judge so of the picture, because they undervieu it. If the perlon you draw be very low or a child, then use the like discrecion in placing him som what lower than your selfe. If you draw from head to foot, let the party stand at the least 6 yards from you when you take the discripcion of his whole stature ; and so likewise for the stelling of your picture of what length soever, according unto the proporcions of the Face : let the party arise and stand, (for very few can sit so upright as they stand) whereby the Drawer oft times is greatly deceived, and the partie drawn dis-figured. Stell not a Childe when you draw the hand, but when you espy a good grace in the hand, take it quickly, and pray them not to stand still, for commonly they give the hand a more unnaturall or affected grace.

First, draw the stroak for the Fore-head, which must bee done most exactly, because that according unto that scantling and proporcion, must all the rest be drawn ; as if the Fore-head be so long, then from the Fore-head to the chin, must be twice so long ; next draw the farthest Eie, thirdly draw the Nose, fourthly draw the nearest Eye, leaving the just length of an eye between it and the other ; having continuall regard that the parties farthest eye, seem to your appearing to be just so much distant from the Fore-head stroak, as it was when you first began ; if it be not, proceed on further untill you have recovered or recalled him to his former place, then draw the Mouth, next the Chin, then finish the out line of the Face ; and lastly, the hayr : having finished the Head, draw the whole Bodie proporcionable thereunto.

Of Shadowing.

The chiefest part of Drawing, consisteth in the tru proportioning of a Picture, for the Line sheweth all unto a good judgment : but the Shadow without the Line sheweth nothing. The Line only sheweth the Countenance, but the Line and Shadow, sheweth the lively likenesse.

Shadows best become great pieces, and such as are to be viewed afar off.

To shadow sweetly, and round withall, is a far greater cunning than to shadow hard and dark; for to round a work cannot be without some Shadows, but to shadow as it were not shadowed, is best of all. Every thing must bee done in its proper kind.

Shadows do shew the effect or defect of the Light in the place where the picture was drawn.

Thus much for those that are contented to take some pains to attain to so noble a Science: Now there follow certayn Directions for those that are unskilfull, and have not spare time sufficient to spend in the practice of the foremencioned Directions, yet are desirous (upon occasions, and for certayn ends) to take the copy of some Letters, Prints, and Pictures that they oftentimes meet withall: the which are so facil and easy, as that children of but indifferent discretion, may perform the same.

How to take the perfect draught of any printed, or paynted Picture.

Take a sheet of Venice paper, or else of the finest white paper that you can get: wet it all over with clean Sallet-oyl, then wipe the oyl off from the paper as clean as you can, so that the paper may bee dry, otherwise it will spoyl a printed picture by the soaking thorow of the oyl: Having thus prepared your paper, lay it upon any paynted or printed picture, and you shall see the picture thorow the same more perfectly appearing than thorow glasse, and so with a black Lead Pen, you may draw it over with ease, and better first with a soft Charcoal, and then with a Pen. After that you have thus drawn the picture upon the oyled paper, put it upon a sheet of clean white paper, and with a little stick pointed, or (which is better) with a feather taken out of a Swallowes wing, draw over the picture agayn, and so you shall have the same very prettily and neatly drawn upon the white paper, which you may set out with Colours, as shall be taught hereafter.

Another way.

Having drawn the picture, (firft open the oyled paper) put it upon a sheet of clean white paper, and prick over the same drawing with a good big pin, then from the clean sheet that is pricked, pounce it upon another; that is, take some Small coal,

coal, ponder it fine, and wrap it in a peece of Tiffany or such like, and binde it up therein loosly, and clap it lightly over all the pricked lines by little and little, and afterwards draw it over agayn with a Pen or Pencill, or otherwise as you please.

Another way.

Take a sheet of thin white paper, and rub it all over one side with black Lead, or else with Vermilion tempered with a little fresh Butter; then lay the colored side upon a sheet of clean paper; then lay the Picture you would copy out, upon the other side of the coloured paper, and with a small pointed stick, or with a Swallow's feather, go over all the stroaks of your picture that you desire, and then you shall have all the stroaks drawn very prettily on your white paper.

Another way.

Take a peece of clear Lantern horn, and lay it upon your picture; then with a Pen made of a Ravens quill, draw the stroaks of your picture upon the horn, and when it is dry, breathe upon the horn twice or thrice, and presse it hard upon a peece of clean white paper a little wetted, and the picture that you drew upon the horn will cleav fast upon the paper.

Another way.

Take a sheet of white paper, rub it all over with fresh Butter, and dry it by the fier; then rub one side of it all over with Lamper black-lake, or any other colour finely ground, lay this paper upon a sheet of clean paper with the coloured side downwards, and upon it lay the picture you would copy out, and trace the stroaks over with a feather of a Swallow's wing, and you shall have your desire.

Another way very pretty, and easy to be performed.

Take some Lake and grinde it fine, then temper it with Linseed oyl, and afterwards with a pen draw with this mixture (instead of ink) all the out stroaks of any printed picture, also the muscles: then wet the contrary side of the picture, and presse it hard upon a sheet of clean paper, and it will leav behind it all the stroaks of the sayd picture that you drew over.

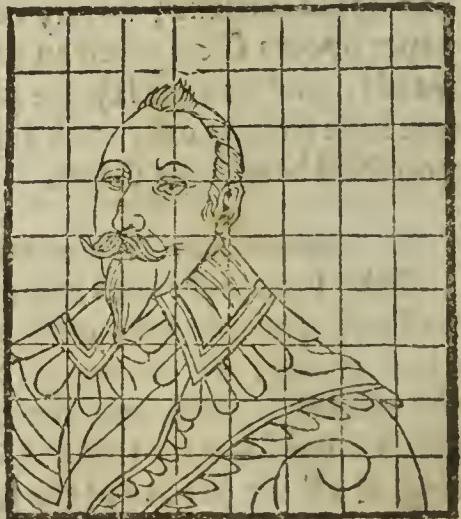
Anot hry.

Another way much like the former.

Take Printers Blacking, grinde it fine, and temper it with fayr Water, and with a pen dipt therein, draw over the master stroaks and out lines of the Muscles : wet then a fayr paper with a spunge, and clap the picture upon it, pressing it very hard thereupon, and you shall finde the stroaks you drew, left upon the fayr paper.

An easie way to lessen any picture : that is, to draw a picture from another, in a lesser compasse.

First, with a Ruler and a black Lead Plummet, draw a line flat at the very top, and another at the bottom, paralell or equally distant from the other : from the upper Line let fall two perpendicular or plum-lines yeven unto the lowermost Line, so those four Lines will make a Square : now you must divide this Square into divers equall parts with a payr of Compasses, and draw Lines with a Ruler and a black Lead Plummet, quite over the picture ; so the lesse Lines will divide the picture into equall parts or Squares ; then take a fayr paper, and make as many Squares upon it as there is in the picture : yon may make them as little as you will, but be sure that they are equall, and of just number with those in the picture. Having thus crossed your picture, and drawn over your fayr paper into Squares, take a black Lead pen, and draw the picture by little and little, passing from Square unto Square, untill you have finished the



whole;

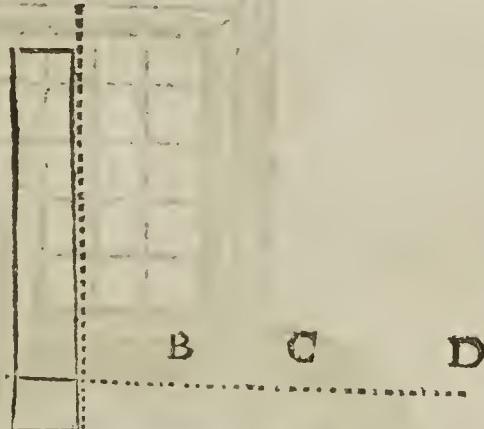
whole ; still observing the order of the Squares as they stand in either : then draw it over with a pen, in which second drawing of it over, you may easily mend any fault : when it is dry, rub it over with the crum of white bread, and it will take off all the black Lead strokes, and your draught only will remain fayr upon the paper or parchment.

The following figure noted B A signifieth a Ruler, which will assist you to crosse your paper with Squares.



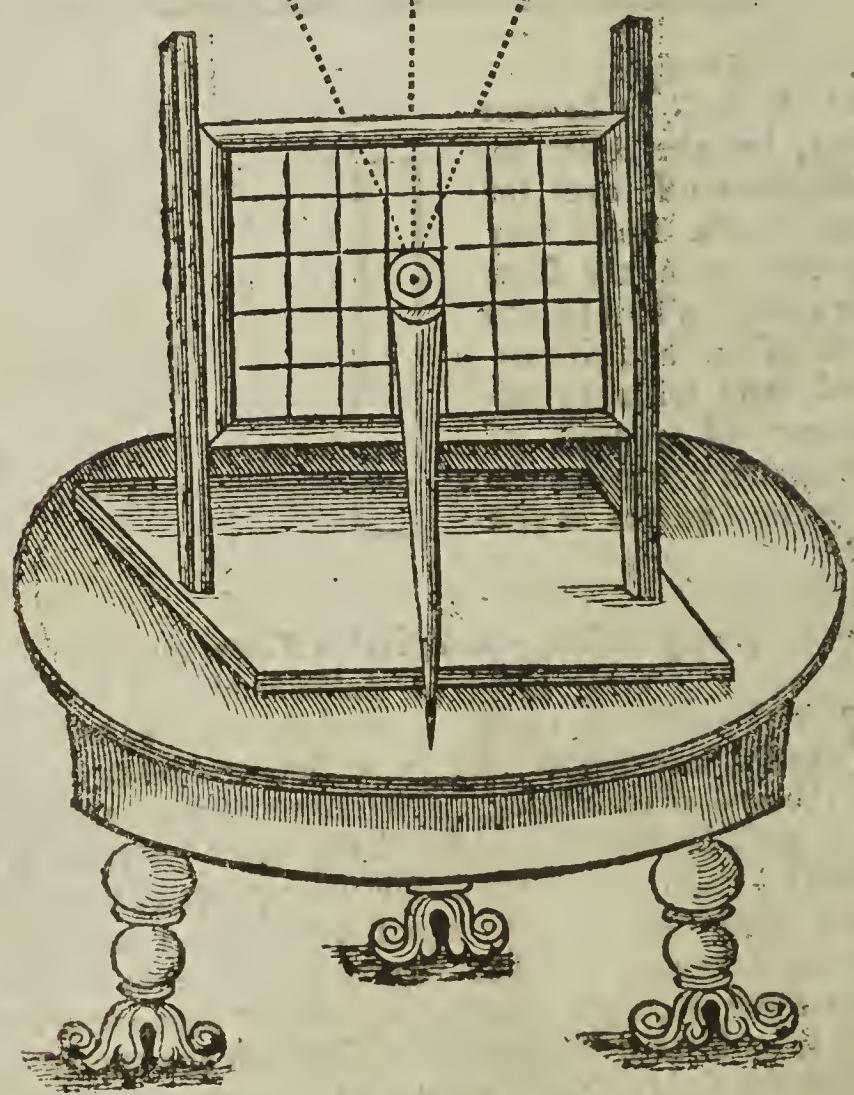
Example.

Let A B C D be one Line, lay the Ruler so, that the crosse over the end of the Ruler may lie full upon the Line, then draw a Line by the side of it, and so proceed, and with the assistance of a payr of Compasses you may make A as many Squares as you list.



*A very easie way to describ a Town, or Castle :
being within the fullsight thereof.*

For the effecting of this, you must have a frame made, and crossed into equall Squares with Lute strings, and figured at the end of each string : this frame must have a foot, wherein it must be made to be lifted higher or lower as occasion serveth ; also you must divide your paper that you are to draw upon into so many equall Squares as your frame containeth : having the like figures at the ends of each Line that there is on the frame ; before this frame must be placed a style or bodkin having a little glasse on the top of it for to direct the sight. Note, now that the nearer any thing commeth unto the center, the lesser it appeareth : hence it is,

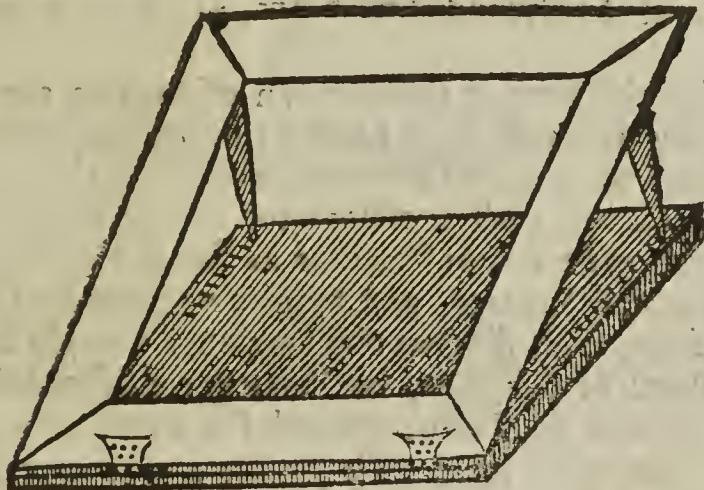


that a Town of a mile, or more long, or a huge great Castle, at a distance may be comprehended, and that easily within the limits of so small a frame ; By the rule direct your sight from one part to another, beginning at one Square, and proceeding through the rest in order as they lie ; mark well the foregoing figure.

By which figure you may make the thing you imitate bigger or lesser according as you shall move it nearer or farther off from the thing, tracing the Work with a cole. Note, that if you move any part, the Work will be false, except you return unto your first place.

How to make a Desk ; by meanes whereof you may draw, and that most exactly with great facility any printed picture, or solid Image.

First let there be a Frame made, and with hinges let it bee joynted unto a board of equall bredth unto it : let this Frame also have two stayes at the top, at each end one, by meanes whereof the Desk may bee raised higher, or lower, as need shall require ; then fasten to the Frame a peece of pure clear glasse fitted thereunto, and it is finished. The figure followeth.



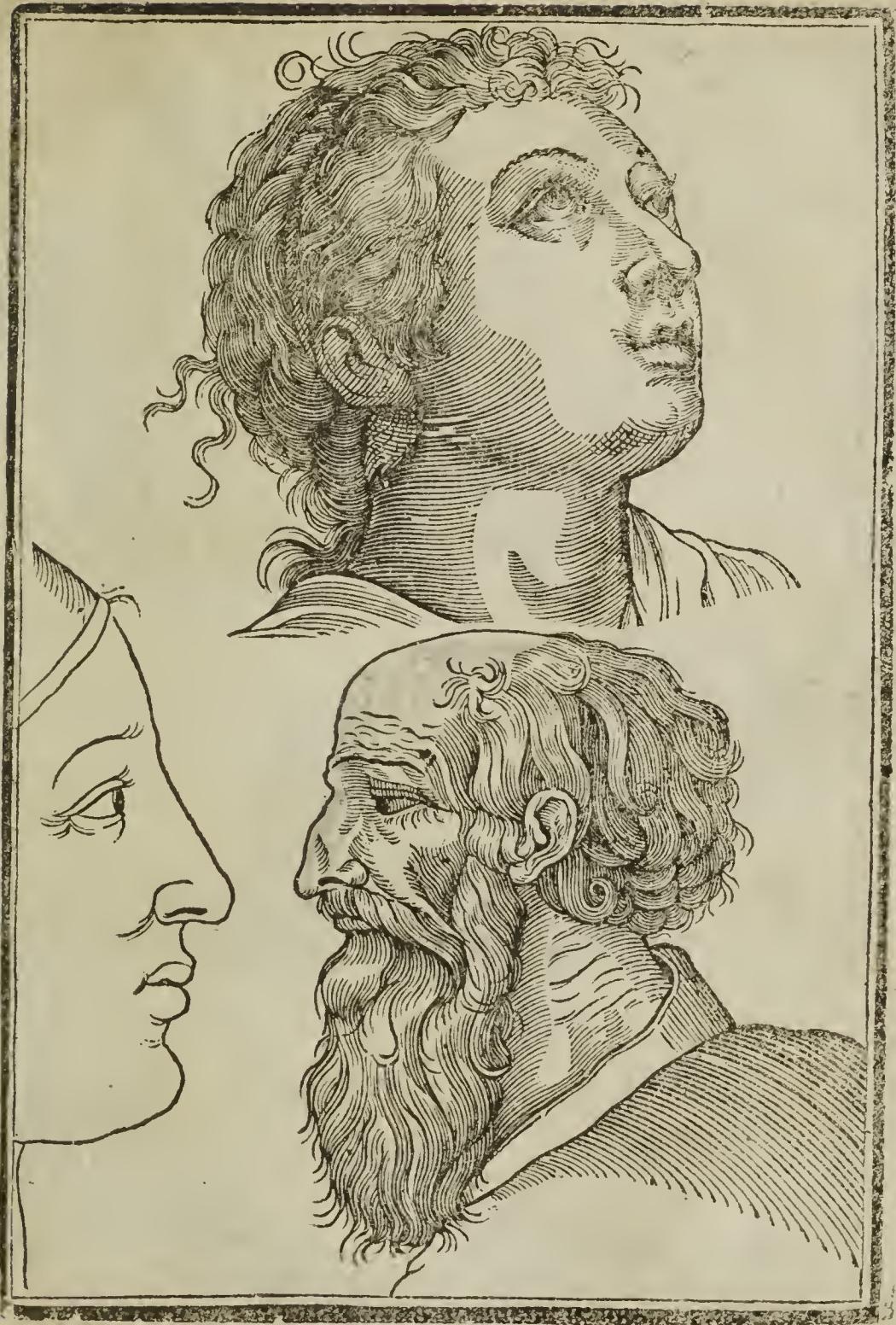
The manner of using this Desk is thus : If the picture that you intend to draw be a printed one, then first fasten it next unto the Desk with wax, paste, or such like : upon it fasten a sheet of fayr paper : If it be in the day-time, place the

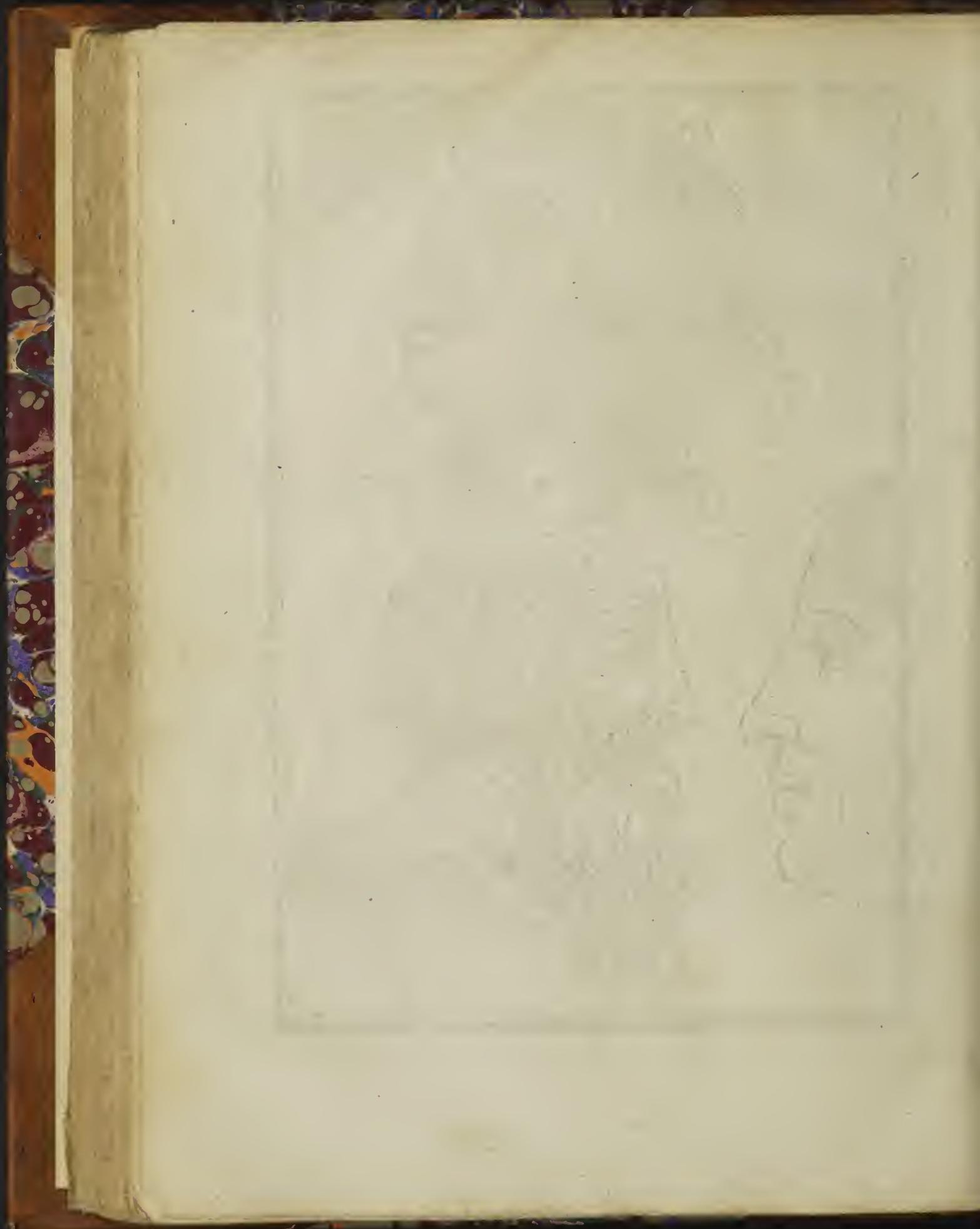
back of it towards the Sunne ; if it be in the night that you work, place a Lamp behinde it, and so you shall see perfectly every (even the least) stroak of the picture, which with your pen you may draw as accurately as any Limmer whatsoever. If it be a sollid peece, then place it behinde the Desk, between the light and the Desk : then fasten a sheet of clean white paper upon the Desk ; rayse then the Desk higher or lower, untill you see the perfect shadow of the Image thorow your Desk, and paper, and then draw the posture of the Image, and shadow it afterwards (without the Desk) as light falleth upon it.

An easie way to take the naturall and lively shape of the leafe of any Herb or Tree, which thing passeth the Art of Man to imitate with Pen or Pensill.

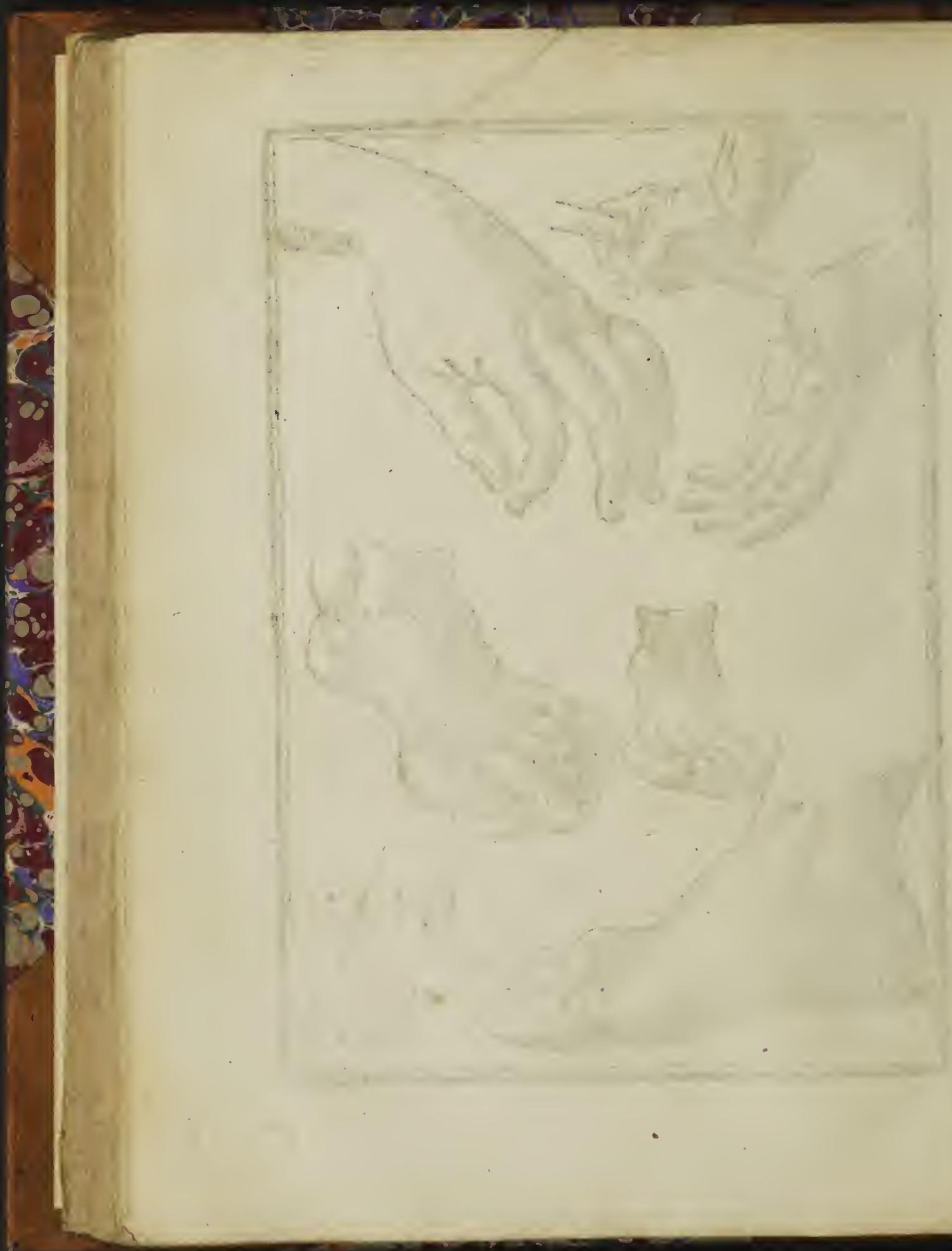
FIrst take the leafe that you would have, and gently bruise the ribs and veynes on the back side of it, afterwards wet that side with Linseed oyl, and then presse it hard up on a peece of clean white paper, and so you shall have the perfect figure of the said leafe; with every veyn thereof; so exactly exprest, as being lively coloured, it would seem to be truly naturall: by this we learn, that Nature being but a little adjuvated or seconded with Art, can work wonders.

Now for the further informacion of such as are desirous of exemplary instruction, I have set down in order following the delineacion of the proporcion of such things as in my judgement seemed most necessary for young beginners, and those in such easie demonstracions as for the most part they consist of equall Spuares, and require no more for their right understanding, then diligent observacion : I might have filled a whole Book of such like, but having considered that what I had done, was a sufficient ground for a further procession, I thought fitting to leave each person to the exercise of his best Invencion.



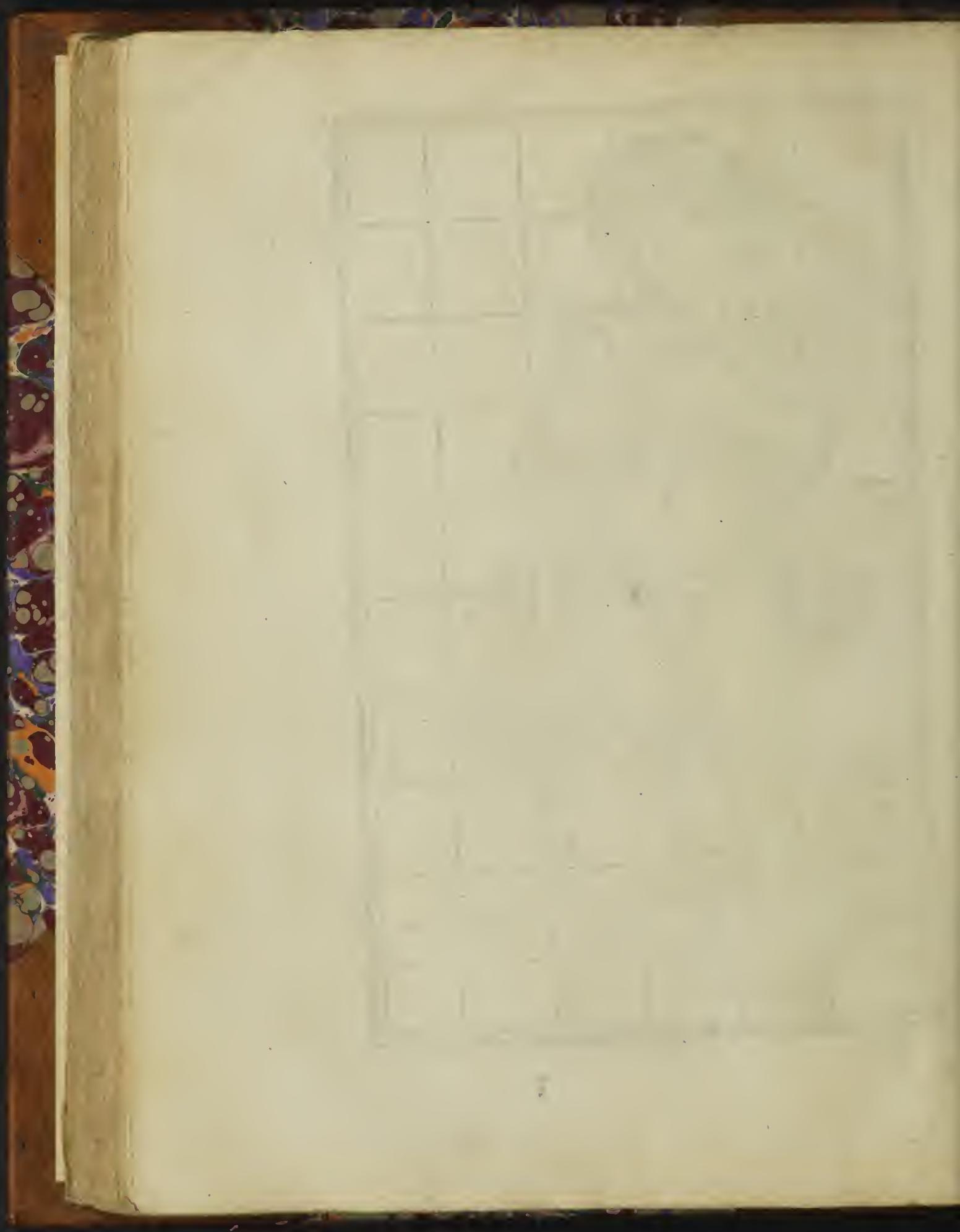


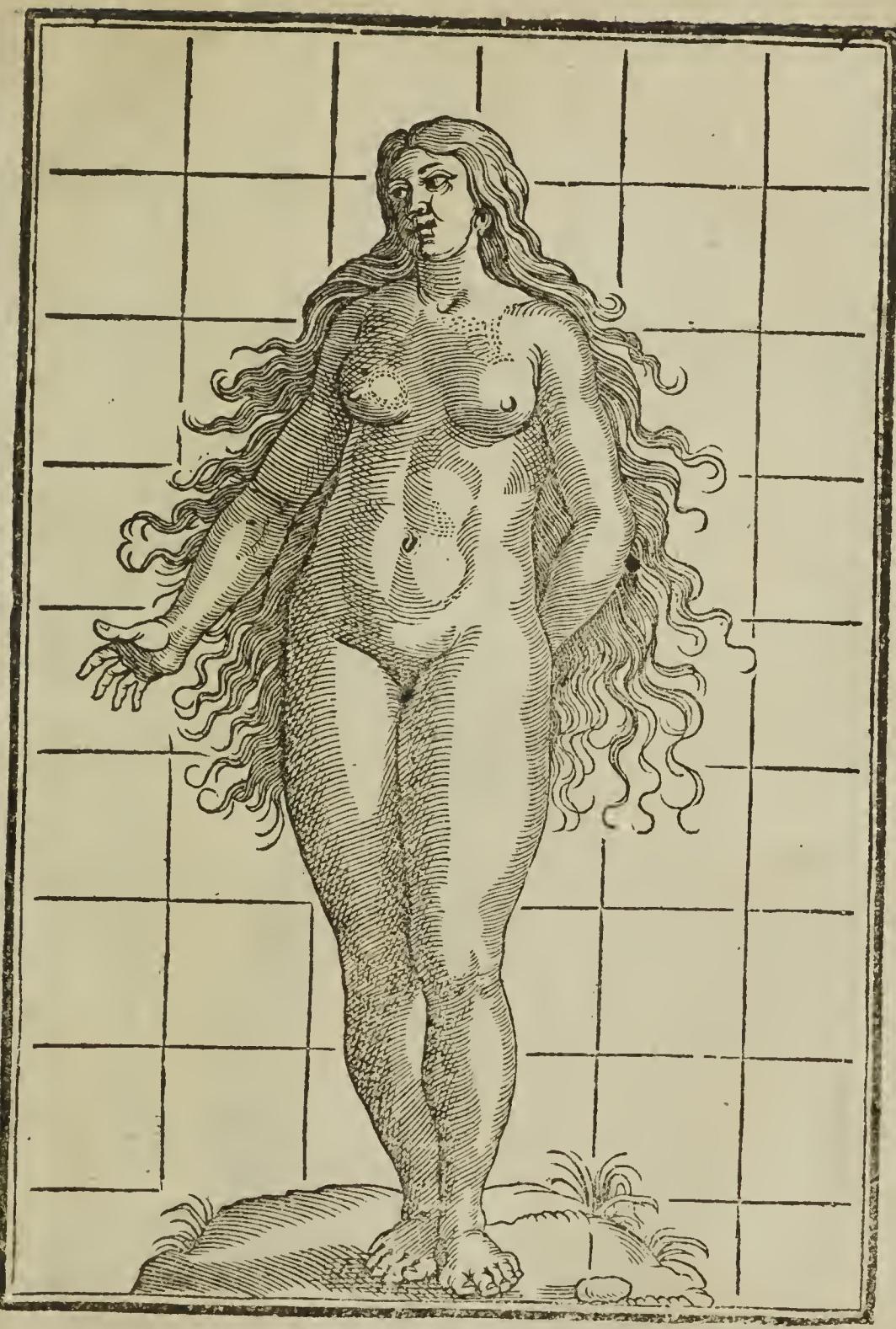




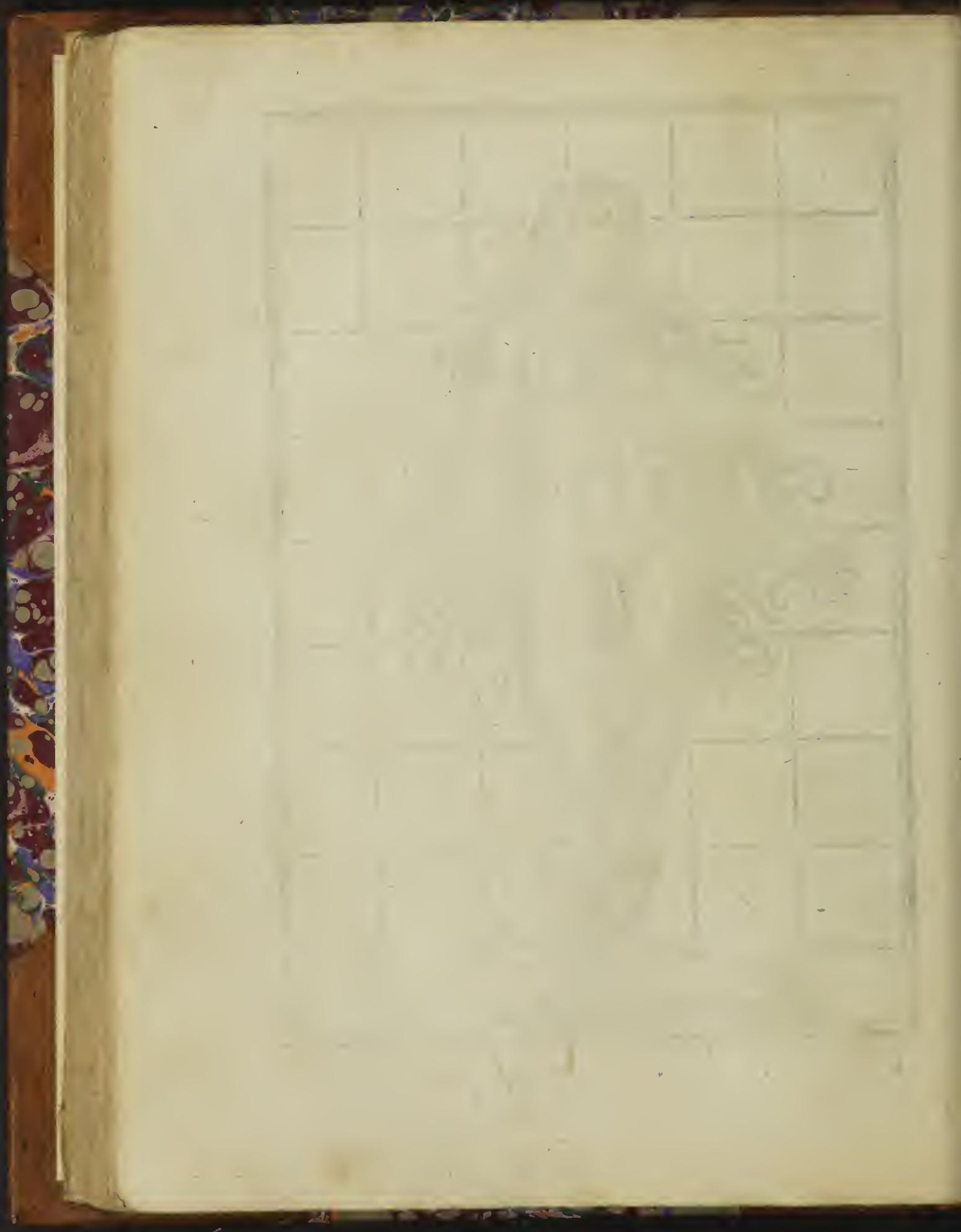


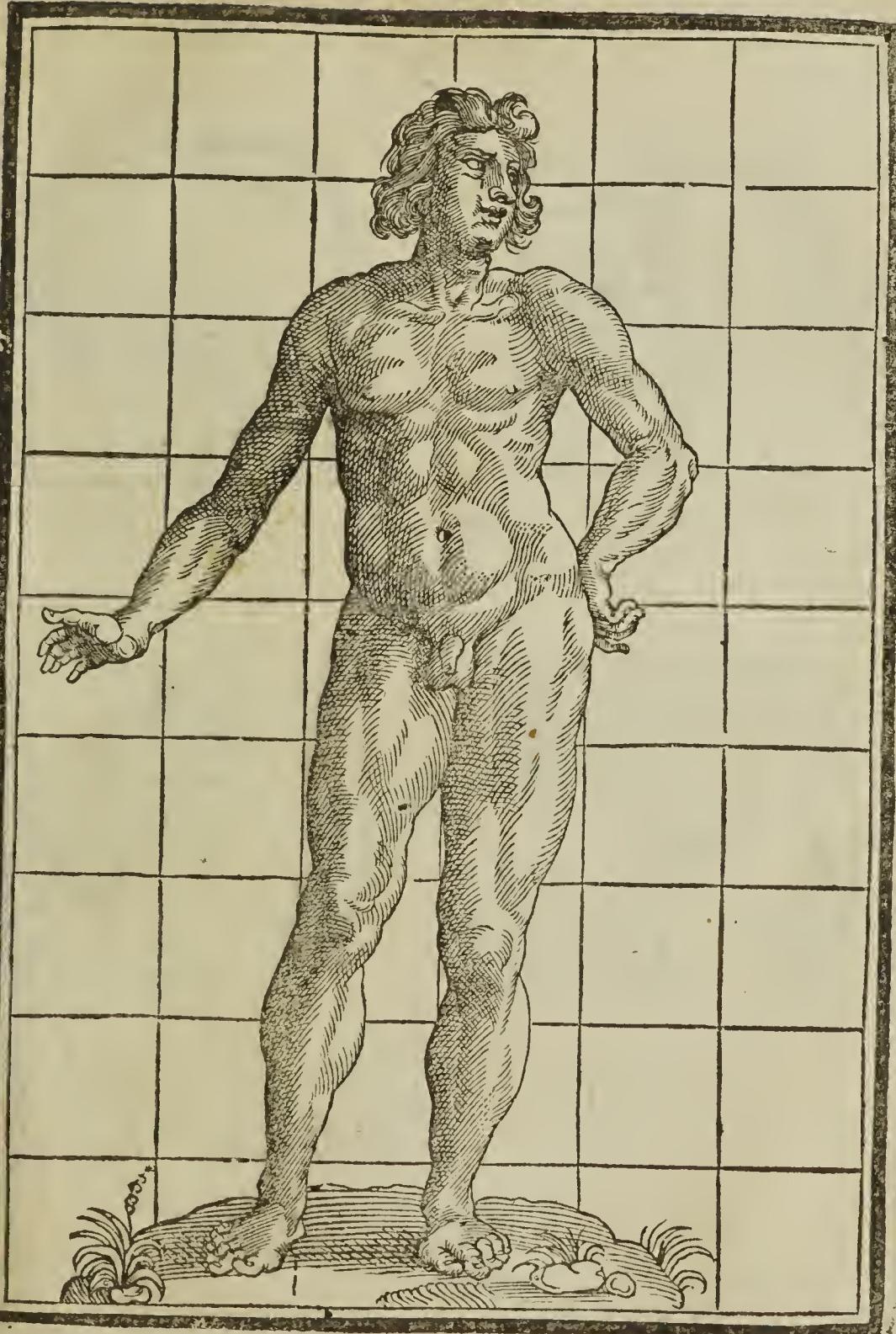
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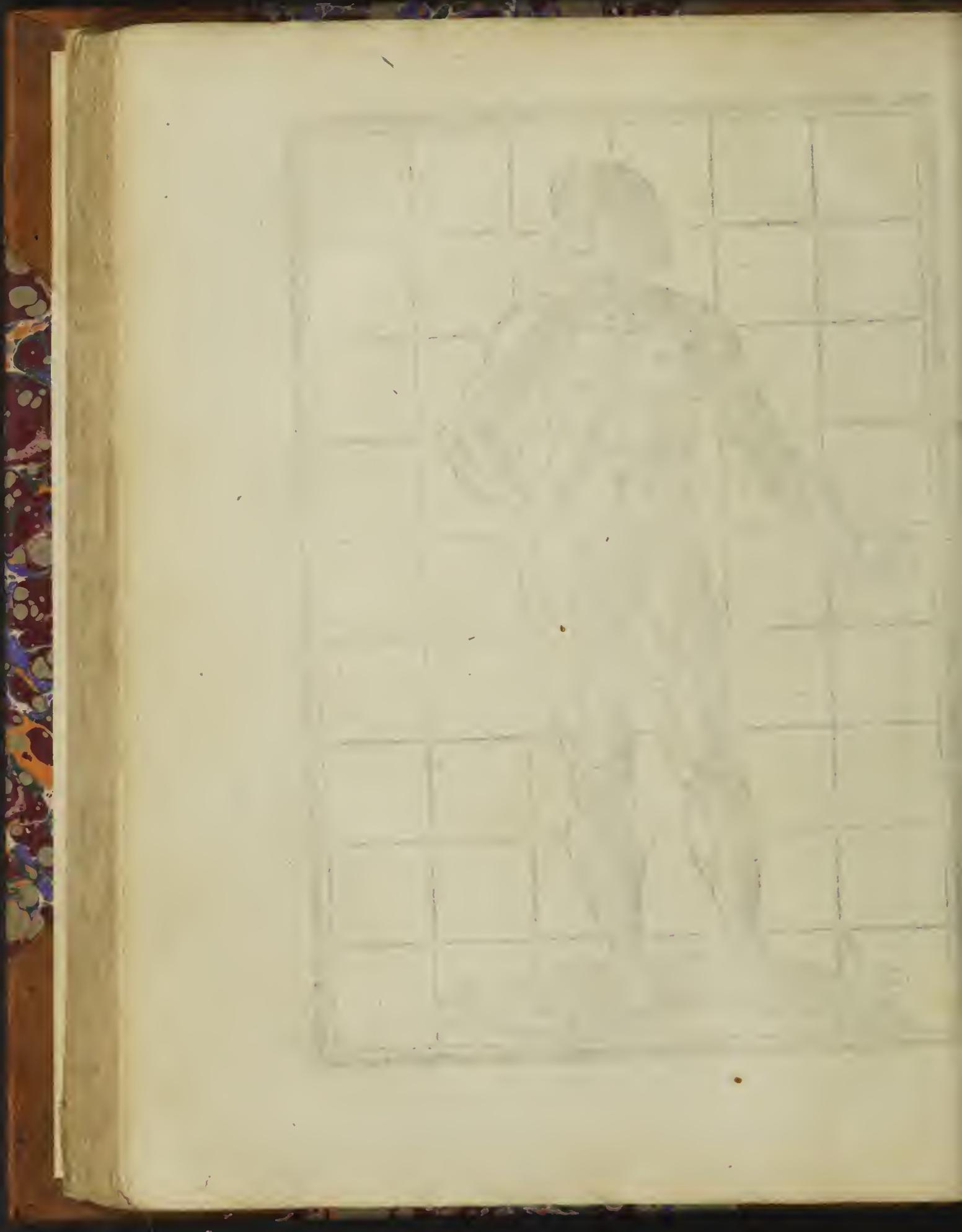


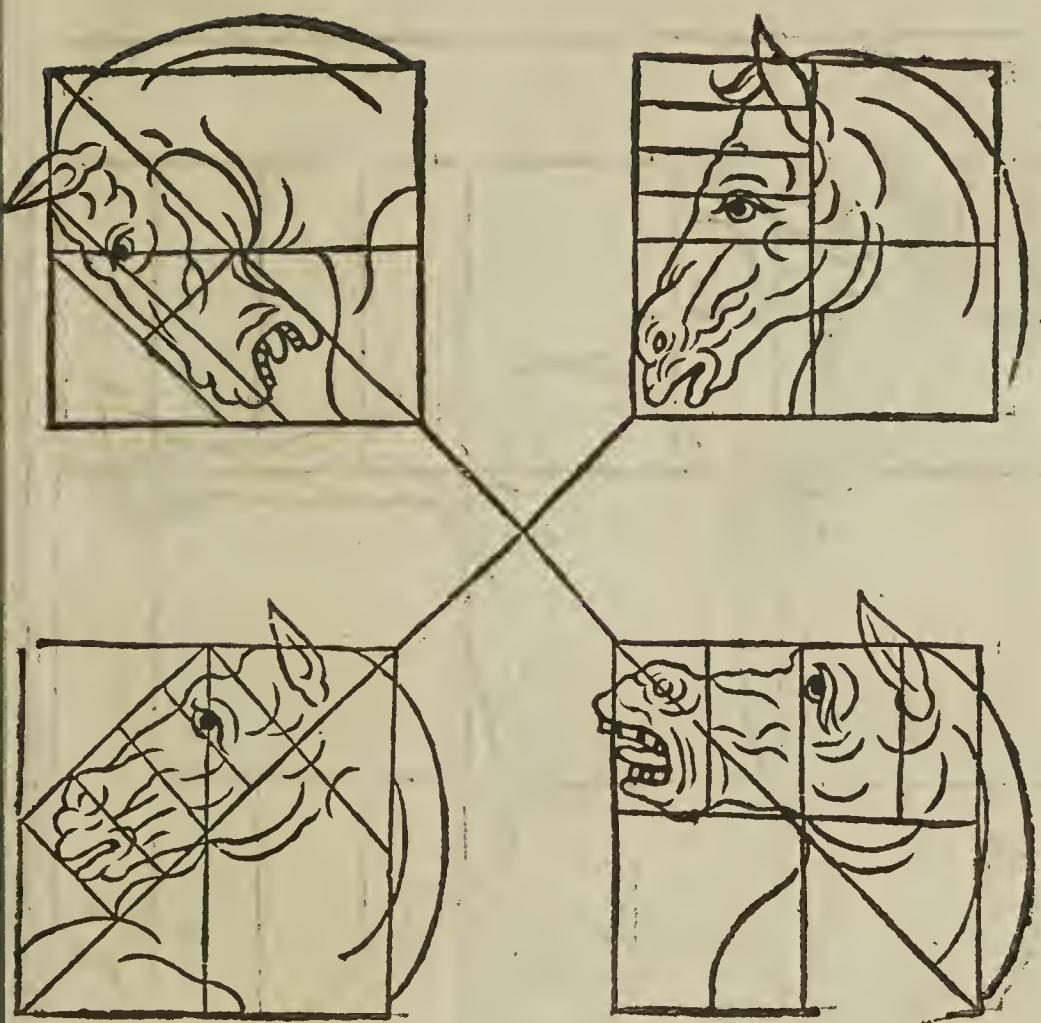


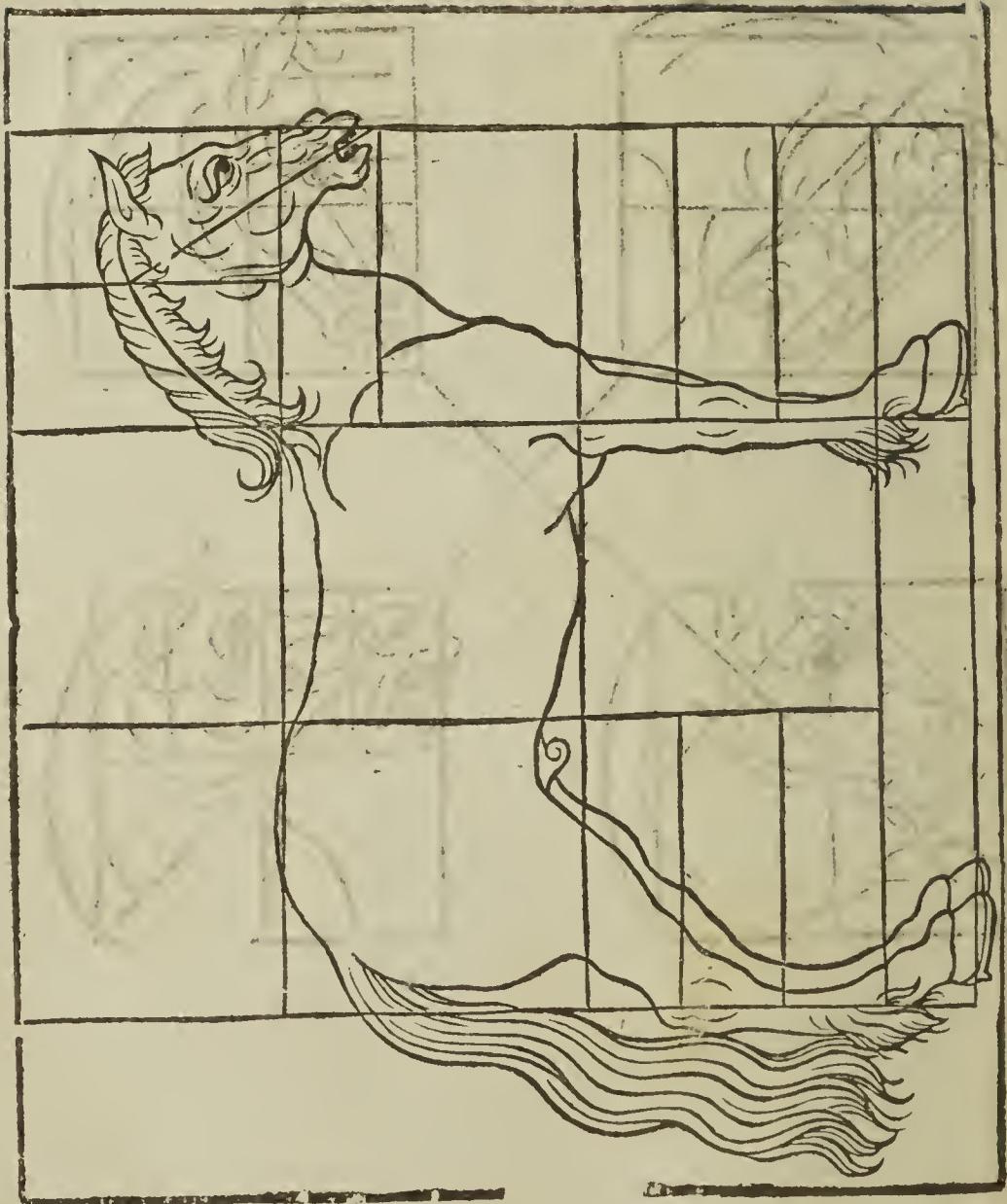
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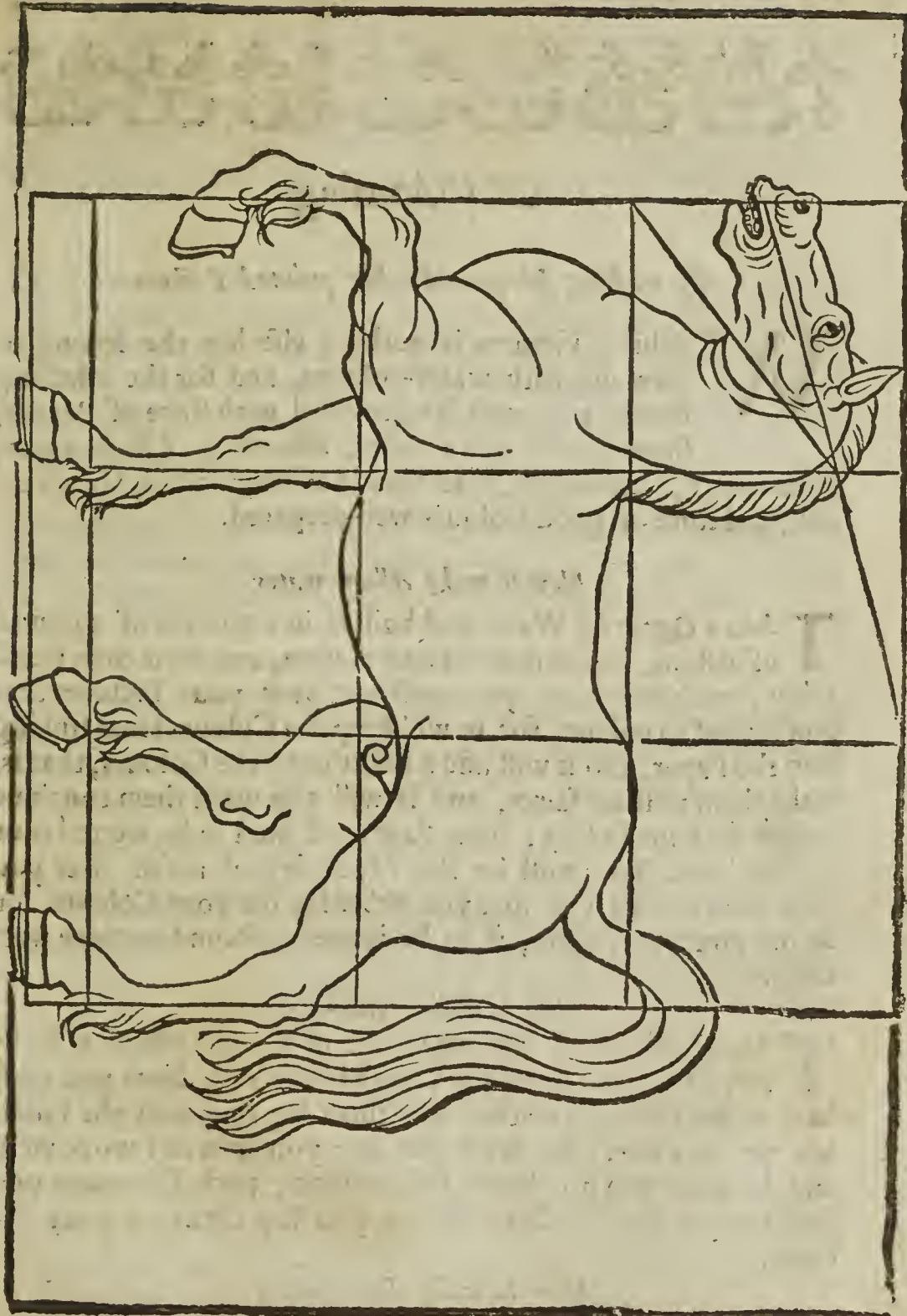














Of Colouring.

Of washing Maps, and other printed Pictures.

WAshing Pictures is nothing else but the setting of them out with water-colours, and for the effecting hereof you must be provided with store of Pencils, some smaller than other, also with Allum-water, Lime-water, Gum-water, water made of Sope-ashes, Size, Varnish, and store of good Colours well prepared.

How to make Allum-water.

TAke a Quart of Water and boil it in a quarter of a pound of Allum, seethe it untill it be molten, and let it then stand a day; with this water you must wet over your Pictures that you intend to colour, for it will keep the Colours from sinking into the Paper, also it will add a luster unto the Colours, that is, make them to shew fairer, and it will also make them continue longer without fading; some Paper will need to be wetted four or five times. You must let the Paper dry of it self after you have once wetted it, before you either lay on your Colours, or before you wet it again, if so be it need a second or more wettings.

How to make Gum-water.

TAke clean water, and put into it of Gum Arabick a little, and let it stand untill the Gum be dissolved. Now you must have a care that it be neither too thick by reason of the Gum, nor yet too thin; for with the one you can not work well, and the other will not binde fast enough; with this water you must temper your Colours before you lay them on your Picture.

How to make Lime-water.

TAke unslack'd Lime and cover it with water, an inch thick, let it stand so one night, in the morning pour off the clear water,

water, and reserve it in a clean thing for your use; with this water you must temper your sap green when you would have a bleu colour of it.

How to make water of Sope-ashes.

S Teep Sope-ashes a night in Rain-water, in the morning pour off the clearest: this water is to temper your Brasil with.

How to make Size.

T Ake a quantity of Gleu, and let it steep a night in water to make it the readier to melt in the morning; then set it on a coal of fire to melt, which done, (to try whether it be neither too stiff, nor too weak, for the meanest is best) take a spoonfull thereof, and set it in the ayer to cool, or fill a Muscle-shell with it, and let it swim in cold water to cool the sooner, If it be too stiff when it is cold, put more water unto it, if too weak, then put more Gleu unto it, and when you will occupy it, make it leu-warm, and so use it: this is to wet your clothes in if you intend to paste your Map or Pictures upon Cloth.

Of the manner of pasting Maps upon Cloth.

F irst, your Clothes must be clean washed, and dried, then wet them in your Size, and wring it then hard out, so nail them stiff upon a Board or Wall, then take your Map and wet the printed side with Allum-water and a Brush, then turn the other side while it is wet, and paste it all over with a Brush, & so spread it upon your Cloth being wet, then dry it thorowly, and lastly lay on your colours. Note, that if you intend to vernish your Picture after it is coloured, then you must wet it at the first with thin white Starch warmed, instead of Allum-water, but Size is better, or else the Vernish will soak quite thorow it.

Note also, that unto every half pound of Vernish you must put two ounces of Oyl of Turpentine, or else you cannot work it, it will be so thick.

How to prepare your Colours.

S uch colours as have need of grinding, you must first grinde them with fair water, and then put them upon a smooth chalk-stone, and let them dry; then grinde them again with Gum-water, and reserve them in Muscle-shels for your use.

Chuse to lay on the thinnest and most transparant colours,

especially if it be good work that you are to colour, so the one will set out the other; but if the work be none of the best, then endeavour to hide the imperfections thereof by laying your colours the thicker on it.

A Sea Colour.

Take Privet-berries when the Sun entreth into *Libra*; about the thirteenth of *September*, dry them in the Sun; then bruise them, and steep them in Allum-water, and strain them into an earthen Porringer that is glazed: or you may use them before you dry them, for the drying of them is to make them keep long.

Another.

Take bleu Inde and steep it in water, and put to it a little Verditer.

A yellow colour.

Take yellow berries and bruise them a little, and steep them a quarter of an hour in Allum-water, then strain them if you will, or let them stand in the liquor, and work therewith.

A Russet colour.

Take the fattest Sut you can get, and put it into a Pot of clear water, so that it be covered two or three fingers, and let it seethe well; which done, strain it thorow a cloth, and set it on the fire again to thicken, (but take heed you set it not on too hot a fire, for fear of burning it) so let it boil gently untill it be as thick as you would have it.

Colour for faces.

First, lay upon the cheeks little spots of Lake or red Lead, then come all over it with white, and a little Lake; shadow it with Lam-black or Umber, and white Lead.

Hair colour.

Take Umber of Spanish brown, grinde it and temper it with Gum-water.

Colours for naked Pictures.

Take white Lead and a little Vermilion, temper them and lay them on, shadow it with Bolearmenick in the middle, and add a little Sut to the utmost or double hatches.

A colour for dead Corps.

Change white Lead with a little of the water of yellow berries,

ries, and wash the Picture all over, then change it with bleu Inde, and shadow it in the single hatches and leanest places; then take Sut, yellow berries, and white Lead, and with that shadow the darkest places.

A bloud-red colour.

Sinaper, Lake, and Vermilion make a good bloud-red; some have commended Mutton-bloud very highly, but I never tried it.

How to make Mutton-bloud red.

Take some of the clearest bloud of a sheep, and put it into a bladder, and with a needle prick holes in the bottom of it; then hang it up to dry in the Sun; this saith a Painter (that told me for a special experiment) will make transparant and excellent bloud-red colour, which you may dissolve in your Allum-water, according as you have need thereof.

Colours for Garments.

A Purple colour.

Take Logwood and seethe it in Vineger and small Beer in an earthen Pot, and put a little Allum therein, untill you taste it to be strong on the tongue.

A red colour.

Boil Brasil as you did the Logwood, and it will make a red colour: if you would have it a sad red, mingle it with Pot-ash-water, if you would have it of a light red, temper it with white Lead.

A Crimson.

Cynaper tops: Cynaper lake: or Vermilion.

A green colour.

Take Privet berry water, and change it with yellow berry water, and it giveth a perfect green for the ground, and it is much used.

Another green.

Take Spanish green clean pickt and steeped in Rhenish wine; strain it, and put it into a little Honey or white Sugar-candy, and it will make an excellent green.

For a light green.

Temper Verdigrease and white Lead: 2 Verdigrease, as much yellow berries, and a little white.

Yellow colours.

Orpiment and Saffron, Masticot, Cambougium; either of these give a very good yellow.

Blen colours.

Verditer, Azure or Bice, bleu Inde.

Colours for building.

Lay black and white Lead for the walls of Churches, Conduits, and greater buildings; Bolus for the pillers, and lesser houses; red Lead for Tiles; for the Leads bleu and white; for cottages Sut alone.

Colours for Landskip.

Lay Verditer, bleu, white, and green; or first go all over it with Saffron, and white; then put a little Sut to them, and go over it again.

Or first take green and white Lead, and go over it, shadow it with a little more green, then with white, and last of all with green, a little white and yellow berries.

Skie colours.

Brasil and white Lead is the lightest, then light purple and white, then Inde bleu and white, the darkest of all is Inde bleu.

Cloud colours.

The lightest of all is white Lead and Inde bleu, a like quantity of each: the next, a great deal of Inde and a little white; then purple and white with a little Brasil; then white Lead and yellow berries.

Colours for the Sun-beams.

Lay yellow berries with a little white, shadow it with Saffron and red Lead.

A motley green.

This colour is compounded of red and green.

A Lincoln green.

This colour is compounded of a good green and Saffron.

A popinjay green.

This colour is compounded of Azure and Masticot, or bleu and yellow.

COLOURING.

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An excellent green.

Take Copper plates, put them into a pot, and put some distilled Vineger unto them, set them in a warm place until the Vineger become bleu, then pour that Liquour or coloured Vineger into another Pot well leaded, and pour more Vineger upon the Copper-plates again, letting that also stand untill it be of a bleu colour, then pour it unto the former Liquour, this you may do so often untill you have Liquour enough, then let that Liquour stand in the Sun until it be thick enough.

A Lion-tauney.

This colour is made of red Lead and Masticot.

A Peach colour.

This colour is compounded of Ceruse and Vermilion.

A Brass colour.

This is made of Masticot and Umber.

A Marble or Ash colour.

This colour is made with black and white.

A russet colour.

This colour is made with a little white, and a good quantity of red.

A brown bleu.

It is made of two parts Inde baudias, and a third of Ceruse.

A Crane colour.

It is made onely of black Lead ground with Gum-water.

To write Gold with the Pen or Pencil.

Take a shell of Gold, and put a little Gum water into it, and stir it about, and then you may work with it as with colours.

Thus by a little practising and tempering your colours one with another, you may with the same colours compound divers others that I have not mencioned, nay almost what you list.

Of



Of Limming.

Limming consisteth not onely in the true proportioning of a Picture, but also in a neat and lively colouring of the same, whereby the work is so graced oftentimes, that smaller faults are seldom perceived, except it be by those that have very good judgment: and herein I will speak first of the names of all the colours pertaining thereto; also of the names of your Gums and Golds; then how you shall dissolve your Gums; then of grinding your Colours, and making them operative; of all your Waters to diaper, damask, and set out your Colours. Lastly, of making your Gold sizes both for burnished and set Gold, and to make your Gold small to armoniack with a Pencil, for writing, stock-painting, and other work.

The names of all the Colours pertaining unto Limming.

Bleus.

- 1 Bleu Bice.
- 2 Inde Baudiis.
- 3 English Inde.
- 4 Litmose bleu.
- 5 Flory bleu.
- 6 Cork or Orchal.

Reds.

- 1 Vermilion red.
- 2 Red Lead.

Sanguins.

- 1 Sanguis Draconis.
- 2 Turnsole.

Greens.

- 1 Green Bicc.
- 2 Verdigrease green.
- 3 Verditer green.
- 4 Sap green or Pancy green.

Yellows.

- 1 Orpiment yellow.
- 2 Pinck yellow.
- 3 Oker de Luce.
- 4 Masticet or General.

Crimsons.

- 1 Fine Rosset.
- 2 Sinaper lake.
- 3 Sinaper tops.

Whites.

- 1 White Ceruz.
- 2 White Lead.
- 3 Spanish white.

Blacks.

- 1 Black chalk.
- 2 Coppres black.
- 3 Sable black.
- 4 Base black.
- 5 Lamp black.

Browns.

- 1 Spanish brown.
- 2 Bole armenick.
- 3 Umber.

The names of your Gums.

- 1 Gum Armoniack.
- 2 Gum Lack.
- 3 Gum Hedere.
- 4 Gum Arabick.

The names of your Golds.

- 1 Liquid Gold.
- 2 Gold Armoniack.
- 3 Gold burnished.
- 4 Set Gold.

How to dissolve your Gums.

The manner of dissolving Gum Armoniack; and for what use it serveth.

Take Gum Armoniack and grinde it with the juyce of Garlick as fine as possible may be, then put thereto two or three drops of weak Gum-water of Arabick, and temper it so that it bee not too thick, but that it may bee conveyed out of your Pen; then write therewith what you will, and let it dry; when you would gild it, cut your leaf Gold or Silver in small pieces according to the writing you are to lay it on: first then breathe upon your writing or Drawing, and incontinently set your Gold or Silver hard on with a piece of Wooll, then let it dry thorowly, afterwards with a fine Linnen cloth strike away the loose Gold or Silver, and you shall finde the sithe you formerly drew to, though it be as small as the hair of your head, to be clean Gold or Silver, and this is called Gold Armoniack, and it may serve also to temper liquid Gold with.

Gum Hedere, how to make it, and to what use it serveth.

Seek a Tree that hath a great branch or arm of Ivie, then then hew the Ivie asunder in the midst, and bruise both the ends of it with the head of your Ax, so let it remain three or four weeks, and then you shall finde a pure Gum much like an Oyl to issue forth of the ends thereof, which gather up; for it is good to put into your Gold-size, and also into your other Colours, and that for three causes: first, it will stay the taste and odour of your size. Secondly, it will prevent the bubbles that would arise upon your Gold-sizes and other colours. Thirdly, it will make that the colours shall not be fat and clammy.

How to make Gumlack, and the use thereof.

Take the glayr of Eggs, and strain them as short as you can, in the Moneth of March; to a pint of this put a spoonfull of the finest Wort that you can get, also take Honey and Gum Hedere, of each as much as a Hazle-nut, and put to them four Spoonfulls of the finest Wort, strain them with a piece of Sponge so long that you see them a clear Oyl; put both these together into a Glass, and let it dry, and it will be hard like Amber, which you may dissolve in clean water, as you do Gum Arabick. This is the best Vernish that is, and it is good to lay many Colours with, as you shall finde in the temperature of them.

How to make Glayr.

Take the whites of Eggs, and beat them with a spoon (or whisk, which is better) till it rise all in a foam, then let them stand all night, and by the morning they will be turned into clear water, which shall be good Glayr, wherewith you shall temper your Colours.

How to make Gum-Water for the same use.

Take Gum-Arabick that is white and clear, knit it up in a clout, and lay it in clean water untill it be dissolved and make the water clammy: if you put too much water and too little Gum, you shall have a weak Gum-water, and so of all other Gums. Let it not be so stiff that your fingers stick together being wet therewith, but of a reasonable stiffness.

Of the tempering and making Colours.

Some Painters use first to grinde all their Colours except white, with the Gall of a Neat, and then let them dry, and afterwards they grinde them again with Gum-water, and so use them; water, they say, killeth the brightness, and the Gall maketh the colour more lively.

Observacions.

The practices of a Limmer must be neat and cleanly in all the operacions, in grinding Colours where there is neither smoak nor dust; the water of some clear Spring, the Gum of the whitest and clearest Arabick, broken into pouder: he must also have white Sugar-candy in pouder, and these must be kept close in gally-pots, or jar-glasses: his grinding-stone must be of Chrystall, Porphyr, or green Marble; his apparel such as sheddeth least dust.

Of bleu Bice, how to grinde and temper it.

Take fine Bice, and grinde it upon a clean stone with fair wa-
ter, as small as you can grinde it, then put it into a Horn or
Horse-Muscle-shell, and wash it in this manner following:
First, put thereto your Horn full of clean Water or Vineger,
and stir it well, then let it stand the space of an hour, and all the
Bice will fall to the bottom, and the corruption shall fleet upon
the water, then pour away that water, and then put to it som-
what a weak Gum-water, that the colour may fall to the bot-
tom; let it then stand untill the Bice be all settled to the bot-
tom, then pour away that Gum-water clean from the Bice, and
put thereto other clean water, and so wash it up, and if you
will have it rise to the same colour it is of when it is dry, then
temper it with a weak Gum-water, if otherwise, then temper it
with a stiff Gum-water of Lack.

If you will have it light, grinde it with a little Ceruse.

If you will have it deep, put to it the water of Litmose.

If you will make a false colour hereof, put to it twice so
much Ceruse, and deep it with deep Azure, but after that dia-
per or trace with Ceruse or white Lead.

Bice, Sinaper, Lake, and a little Rosset make a fair Violet co-
lour.

Ultermarine of Venice is the highest bleu, instead whereof
you may use Smalt of the best bleu Bice.

Litmoz bleu.

Take fine Litmoz and grinde it with Ceruz : and if you take Litmoz and a little Ceruz, it maketh a deep bleu! If you put much Ceruz and a little Litmoz, it maketh a light bleu, you must grinde it with weak water of Gum Arabick.

How to make bleu water to diaper and deepen upon all other colours.

Take fine Litmoz cut into pieces, and lay it in a weak water of Gum-lack, and let it lie twenty four hours therein; and you shall have a pure bleu water, as bleu as azure: with this water you may diaper, damask, and set out all other bleus.

Or take a little quantity of unslak'd Lime, and a good quantity of Litmoz, and grinde it with a strong Lime Lye, then put it into a Horn, and let it rot in Hors-dung, the longer the better.

Inde-baudias and English Inde.

Take Inde-baudias and grinde it with the water of Litmoz, if you will have it deep; if you will have it light, grinde it with fine Ceruz, and weak water of Gum-Arabick. In the same manner must you grinde your English Inde, but it maketh not so good a colour as your Inde-baudias, you must diaper upon it with Litmoz-water.

Some instead of this colour use Flory with a little Inde-Rosset, and Ceruz twice as much, and it maketh a light violet.

With one part of Inde, and two parts of Rosset is made a deep violet.

Instead of Inde one may have a little Flory, and for a violet colour it is better than Inde.

Flory must be tempered as is Inde.

Inde is a colour between bleu and black, and must be well ground with Gum-water, and tempered as Rosset is.

Flory bleu.

Take fine Flory bleu, and grinde it with a little Rosset, and it maketh a light violet. Put much Ceruz, and a little red Lead, and it maketh a Crane-feather colour. Grinde this with any yellow,

yellow, general excepted, and also Saffron, and it maketh a fair green.

This colour ground with a little bleu Bice, and a little quantity of Chalk, maketh a light colour.

This colour must be ground with glayr, and tempered with some Spanish white, else it will be little better than Chalk.

Kork or Orchal.

Take fine Orchal and grinde it with unslaked Lime, and with a quantity of urine, and it maketh a pure violet. If you put much Lime, it maketh a light violet. If you put too much Kork or Orchal, it maketh a deep violet; but Orchal is the better colour.

Green colours.

The best green for Limming is Cedar green, instead whereof you may use Verditer green.

How to grinde and temper green Bice.

You must grinde your green Bice on the same manner you did your bleu Bice, also temper and mash it after the same manner; and you must diaper upon it with the water of deep green, as you shall finde hereafter. The longer it is ground, the finer it will be, but the more waste. The refuse of this Bice may serve to make hils and stalks of flowers. Moreover, this colour being a false colour, must be deepened with Sap green; and diapered with Gals.

Verditer green.

Take your Verditer, and grinde it with a weak water of Gum Arabick. This is the faintest green that is, but it is good to velvet upon black, to make the sleeve of an Image, or to velvet a quishion.

Verdigrease green.

Take some Verdigrease, and grinde it with the juyce of Reu, and with a little weak Gum-water, and you shall have the purest green that is: and if you will have it to diaper upon, then you must grinde it onely with the juyce of Reu, and that will make it a worse green, and then your damask or diapering will be perceived.

You must diaper upon it with the water of Sap green.

Sap green.

Take Sap green and lay it all night in tart Vineger, or clean water not gummed, and put a little Allum thereto to raise your colour, and you shall have a good green to diaper and deepen upon all other greens.

How to make Sap green.

Take the Berries of wine Thorn, which is much like unto a Slo-tree, the Berries whereof are black, and grow in clusters like the Berries of Sartridge, whereof Butchers make their pricks; but these Berries differ in this from the Berries of Sartridge; these are full of juyce, and those are dry, and have a hard kernel within them. Take, I say, the Berries of Wine-thorn, and wring the juyce from them thorow a course cloth, and put thereto the pouder of Allum, to preserve the colour of the juyce, then seethe them together untill it be almost wasted away; when it is somewhat stiff, take it out of the vessel wherein it was boiled, and make of it a Ball; when you shall use it, take thereof a little, and put it into a shell of fair water, for it is strong enough of it self.

Of Vermilion red.

Vermilion is a principal and excellent red colour; in the grinding of it add a little Honey to make his colour bright and perfect. There are two sorts of this Vermilion, the one is natural, and the other artificial; the natural is very hardly to be got, and it is a far more excellent colour than the artificial. It is found in small quantities amongst your red Orpiment, and you may easily know it, for it doth much resemble the artificial. The artificial Vermilion is made of Quicksilver, and Citrin, Sulphur or Brimston burned together.

Of red Lead.

Red Lead is made of Ceruse burnt, and unto it you must add a little Saffron in the grinding, for that will make it of an orient and Marigold colour; you must wash it, and take the finest for Limming.

Of Orpiment.

Orpiment is a Mineral, and resembleth Gold when it is broken, it must be first ground with a stiff water of Gum-lake; it giveth the best colour of it self without any mixture: if you lay it upon green, white Lead, red Lead, or Ceruse, they will stain

stain it. There are two sorts of yellow Orpiment ; the one, which when it is broken, looketh, as I said, like unto Gold ; the other is more brittle, and it is of a deep Marigold colour, but being ground, it maketh of it self a most excellent yellow, which I have often used.

Of Pinck yellow.

You must grinde this colour with Saffron if you will have it sad, if light, with Ceruse.

Of Oker de Luce.

Oker de luce is a good hair colour, and a natural shadow for Gold.

Of Masticot or General, or general yellow.

Grinde the Masticot with a small quantity of Saffron in Gum-water, and never make it lighter than it is. It will endure and lie upon all colours and mettals.

Of Rosset, Cinaper lake, and Cinaper tops.

These colours you must grinde each by themselves with Gum-water. Lake of India is of a Crimson colour, other Lakes there are that are blacker, and they must be ground with Sugar-candy or Sugar.

Of Sanguis Draconis.

Sanguis Draconis must first be purified from his dross, and then ground with Gum-water.

Of Turnsoil.

Turnsoil is made of old linnen rags dyed ; you shall use it after this manner ; lay it in a Saucer of Vineger, and set it in a Chafing-dish of coals, and let it boil a little, then take it off, and wring it into a shell, and add thereto a little Gum Arabick, and let it stand untill the Gum be dissolved ; it is good to shadow all carnations and yellows.

Of Brown of Spain, and Umber.

Grinde your Spanish brown with Brasil-water : in like manner grinde your Umber.

Of Bole-armoniack.

Grinde Bole-armoniack with Gum-water.

Of Ceruse.

Ceruse must be grond with glayr of Eggs that hath lien rotting a moneth or two under the ground, and it will make almost perfect white ; this colour being ground and washed, will yield three

three sorts of whites; the first whereof is the finest, and it will glisen, this I call Sattin-white: the second is good for Limming; and the coursest of all being once-ground again, is best to be used for the fleshy colour, properly called Carnacion, which in no sort ought to have any glizening in it. This colour with a little Red Lead maketh the fayrest Carnacion. If the party be pale, lesse Red Lead and a little Masticot among it; if brown, more of each, and a little Oker de rous withall.

Of white Lead

This is the same with Ceruz, but it is not refined as that is; grinde it with a weak water of Gum-lake, and let it stand three or four dayes; Rosset and Vermilion make it a fayr Carnacion.

Of Spanish White.

You must grinde your Spanish white with a weak Gum-water. It is the best white to lace or garnish withall, and it is thus made; take fine Chalk and grinde it with the third part of Allum, in fayr water, untill it be thick like pap, then make it up into Bals, and let them lie by untill they are dry; when they are dry, put them into the fire, and let them remayn untill they be red hot, like burning coales, then take them out, and let them cool.

To make liquid Gold or Silver.

Take five or six leaves of Gold or Silver, and lay them upon your grinding stone, and grinde them with a stiffe Gum-water, and a pretty quantity of Salt, as fine as possibly you can, then put them into a jar-glasse, and fill the glasse almost full of fayr water, to the end the stiffe water may dissolve, and so the Gold may fall unto the bottom of the glasse: let it stand three or four hours, then pour away the liquor from the Gold, and put more clean water, and stir it about, and let it settle again, and then pour off the same water; do this so often untill you see your Gold or Silver clean washed; then take clean water, and put thereto a little peece of Sal-armoniack, and great Salt, and let it stand the space of three dayes in a Box made of wax, then take a peice of Gloves leather, and pick away the skin-side, and put the Gold and the water therein: ty it up then, and hang it on a pin, and the Salt will fret thorow, and the gold will remayn, which you shall temper with the glayr of Eggs and so use it with your pen or pencil.

The

Of Gold-armoniack.

The making of Gold-armoniack you are taught before in the dissolving of the Gums

To make Size for burnished Gold,

Take three parts of Bole-armoniack, and the fourth part of fine Chalk, grinde them togethet as small as you can with clear water, three or four times, and after every time let it dry, and then take your glayr of Eggs, and strain them as short as water, and then grinde your Bole and Chalk therewith, and in the grinding put a little quantity of Gum-hedere to the quantity of a fatch, and four or five blades of Saffron, grinde them all as small as possible you can, and put them into an Ox horn, and let it rot in horse-dung the space of five or six weeks, and then take it up, and let it have the Ayer, for it will have an ill favour, then occupy it when you will, after this manner; lay this Size first upon your parchment, and with a feather lay your Gold or Silver upon it, and when it is dry, burnish it.

How to make another double Size to lay Gold or Silver upon an Embossed ground.

Take Venice Ceruz, white Lead, Plaster of an old Image, or Chalk; any of these made into fine Pouder, and ground with the white of an Eg, and a little water; this will make a good bottom to lay Silver on. But when you use any of these to lay under Gold, put to it a little Saffron, Put not too much water, mingle it after discrecion, and look the Size be thick standing; put the Size thus tempered, in a Horn or Shell, in some Cellar or shadowed place, where it may stand moyst seven dayes, till it be perfect clammy and rotten, and once a day stir it; the older the Size is, the better it is. If there stand any bubbles upon the Size, put in a little care-wax, for that is a remedy against it, and before you lay it on your work, lay the Size upon a horn, and dry it, and when it is dry, bend it, and if it bend and break not, then it is perfect; if it break, put a little water to it, to make it weaker, and proov it if it cleaveth fast unto the paper, if not, put glayr thereto, and it will make it more stedfast, The like Size you may make of Gipsum, Bole-armoniack, red or yellow Oker, Orpiment, or Masticot, with the Brown of Spain, or Red-Lead, if every of them be ground and tempered as the former.

How to set Gold or Silver.

Take a peice of Gum-lack, and dissolve it to a stiffe water; then grinde a blade or two of Saffron with it, and with your Pen or Pencill make what work you please, and cut your Leafe Gold or Silver into peeces, according unto your drawings, and take them up with a feather, and lay them on your drawings, and presse them down with a peece of wooll; when it is through dry, strike off the loose Gold or Silver, and burnish it with the tooth of a Dog fastened in the end of a stick.

Aurum musicum.

Take one ounce of Sal-armoniack, one ounce of Quick-silver, of Counterfoin one ounce, and of Brimston half an ounce, bruise the Brimston, and set it on the fire, but let it not be overhot (lest it burn) then put in the Sal-armoniack being in pouder, also the Quick-silver, and Counterfoin, being well mixed therewith, put them, I say, into the Brimston, and stir them very well, and quickly, with a stick, untill the Brimston become hard, then grinde it on a stone, and put it in a glasse well stopped with wax, and set it in a Pan of Ashes, make a fire under it, and let it stand half a day in that manner, till a yellow smoak ariseth on it, and when the yellow smoak is gone, it is prepared.

Argentum musicum.

Take one ounce of Tin, melt it, and put thereto one Ounce of Tartar, and an ounce of Quick-silver, stirr them well together, untill they be cold, then beat it in a morter, and grinde it with a stone; temper it with Gum-water, write therwith and afterward pollish it.

How to write a Gold Colour

Take a new layd Hens Egg, make a hole at one end, and let the substance out, then take the yolk without the white, and foure times so much Quick-silver in quantity, as of the former; grinde them well together, and put them into the shell, stop the hole thereof with Chalk and the white of an Egg, then lay it under a Hen that sitteth, with six more, for the space of three weekes, then break it up and write with it.

To diaper on Silver or Gold

Diaper on Gold with Lake and yellow Oker, but upon Silver diaper with Ceruz.

*Of the light and place most meet to be chosen, and of
certain necessary Observacions*

Let the light whereby you work, be Northward, somewhat towards the East, which is commonly without Sun-shine; let it be one only light, and that great and fayr, without reflections of wals or Trees, a free sky light, the greater the window, the better, but no bay window; in such a place also where neither dust, smoak, noyse, nor stink may offend, for the colours themselves may not endure some Ayers, especially the Sulphurous Ayers of Seacoal; and in any wise avoyd anger, and shut out busybodies, and such as love to be fingering; and speak not over your picture, for the least spot of wet falling upon it, can never be amended.

In drawing after the life, change not your light, but end your work by the same light that you begin it in; if possibly you may.

Virgin parchment, that is, such as is made of the skins of castlings or abortives, free from spots, and fine and smoothly drest, strained and pasted with starch upon smoothed pastbord, is the best to Lim upon.

When you begin your picture, lay first too fayr a carnacion, for in working you may make it as brown as you will, but being chosen to brown, you shall never work it fayr enough; for Limming is but the shadowing of the same colour that your ground is of. All ground colours in Limming must be layd somewhat flowing, that it dry not before your pencill, lest your work shew rough and patched.

When you draw upon the same ground, be very advised what lines you draw, and draw them very lightly with some of the same carnacion and a little Lake thinly mixed, or with a little thin Lake alone, with a very small pencill, that it may scarce at the first be discerned, untill you be sure that you are in the right way, for afterwards it is very hardly altered. In shadowing also use the same discretion, let it be preformed by little and little, at the first too white, for the face at the first being made never so little too red, or too brown, can never be amended; shadowing to much is never to be amended; also if the hayr be made too dark, or the

forehead too low, they are very hardly or never to be amended ; wherefore make the forehead too high at the first, and you may be sure to amend it, bee not too hasty to lessen it, but proceed with judgment and consideracion.

To draw the trace after the carnacion is layd, and to give the red to the cheeks, take Lake and Vermilion, and for to give the light, take *Venice Ceruz* only, for an old man ad a little Oker unto it, for the shadows take a little black and Lake, but for a woman make it very white, for an old man take the other shadows and a little soot, for the last shadow for the compassing of the face, take Lake, a little black, with some Russet Oker, and soot ; as for the hayr, it must be shadowed according unto the colour thereof.

Shadowing in Limming must not be driven with the flat of the pencill, as in oyl-work, but with the point of the pencill; distemper or washing, with little touches, of colours; very thin and like hatches, though the shadows be never so great, yet must it be made after the same manner, with little touches, but trench not to long in one place, lest it glissen; but let it dry an hour or two, and then deepen it again.

And to make one the more perfect in this work, it were good to practise to hatch some well graven small peeces of *Albertus Durer*, to the end you may handle the point of the pencill in like manner.

Keep your colours ready washed, dried, and ground, each in severall boxes, apart by themselves, and temper them by little and little, as you have occasion to use them ; for a colour after it is once dried in the shell, never worketh so well afterwards. But if it happen that you have tempered too much of a colour, and that it bee dried in the shell, you must temper them with your finger very clean, when you will use thereof, ad a little gum, if it temper not well, but beware you put not too much gum in.

If any colour crack too much in the shell, temper there-with a little Sugarcandy, but not too much, lest it make it shine.

If a colour will not take by reason of some sweaty hand that hath touched your parchment, temper with your colour a little ear-wax, to give it as it were a taste. The same

is good likewise if any colour peel off, to temper the colour that you mend it with, and it will never peel any more.

Want of Gum is the cause that your colours temper like lime or clay, and will draw no line at all.

Of mixing and tempering Colours.

White Lead with yellow Oker, maketh a straw colour; with adding azure, it maketh a sky colour; and so likewise by adding Smalt and Verdigrise, or pinck, it makes the colour of leaves, and herbs. White with the rust of iron maketh the Agat colour. White with Endego, makes a sky colour. White with Vermilion, makes the colour of unripe Strayberries. White with carnacion, makes the colour of damask Roses. White with Umber and other shadowing Earth, makes the colour of barks of Trees, blocks, wood, and stones.

Yellow with Vermilion, makes the colour of fier shining, also an orange Tawny.

Lake and Azure make a Violet or Columbine colour: Vermilion and Lake make the colour of ripe Strayberries, Roses, Rubies, red Lips, blood and scarlet.

Verdigrease with pinck, maketh a very fresh green. Azure smalt, and pinck make a dark green.

Azure with Turnsole makes a purple or violet colour, and so with Rosset, Azure, Sinaper, and black, makes a sanguin or murry colour.

Red Lead and Masticot make a Lion-tauney.

Now all these mixtures may be lightned, and diversly varied, according as they are mixed with more or less, whence arise sundry medlies, which would be too tedious for me here to recite.

Of Liquours to diaper withall.

Cut fine Litmoz in pieces, steep it twenty four hours in Gum-water, and the water will be as bleu as azure, with which you may diaper, and set out all other bleus and Gums for a need. Flory-bleu ground with Rosset, maketh a deep violet,

set, add to it a little Ceruz, and it will be a light violet; put a little more Ceruz, and a little Allum, let it lie all night, and it will be good to diaper on other greens. Cinaper-lake ground with the water of Turnsoil, and stiff Gum-water, will be a deep Crimson, and therewith you may diaper upon a light Crimson.

How to represent Diamonds, and other precious stones.

First, lay the ground, Gold or Silver, as the colour of the stone requireth; when it is dry, burnish it, and draw upon it squares, according as you will have the cuts or squares, then shadow it with transparant colours, according unto the colours of the stones that you endeavour to represent.

How to wash your Pencils.

Rub the ends of them well with Soap, then lay them a while in warm water to steep, then take them out, and wash them well in clean water.



Of Painting in Oyl.

First, I will shew you how to make Size ; secondly, how to prime your Boards and Cloaths ; and also how to black your Frames : then how to temper, order, and lay on your Colours.

How to make Size for your Boards.

Take Gleu and seethe it very long in fayr water, untill the Gleu be quite dissolved, and it is done.

How to make Whiting.

Take the aforesayd Size, and mix it with Whiting ground, heat it, and so white your Boards, being made smooth, after you have whited them, let them dry ; white them over a second or third time, letting them dry after every whiting, then scrape them smooth, then draw it over with white Lead tempered with Oyl.

How to white or prime Cloth.

Take the finest Canvace that you can get, and smooth it over with a Sleekstone, then size it over with Size, and a little Honey, and let it dry, then white it over once with Whiting and Size mixed with a little Honey ; Honey keeps it from cracking, peeling, and breaking out, then you may draw your picture on it, with a Coal or such like, and lastly lay on your Colours.

How to black your Frames.

Temper Lamp black with Size, and therewith black your Frames, you must only put your black unground into your Size, stir it with your Brush, and so work it.

How to gild the Edges of your Frames.

Take white Lead, and a little red Lead, grind them together with

with Linseed oyl, and lay it over the place which you will gild, and let it dry a day or two, then lay it over again with the same Colour, and two dayes after you may cover it with leafe gold ; first with a sharp knife cut the gold in strips, according unto your work, then with a feather lay it on, and presse it down with wooll, when it is dry, burnish it.

Linseed oyl is the best for pictures, but Nut oyl is the best for Ruffes, and all Linnen ; for your Linseed oyl will turn yellow : divers Painters there are, who having haste of work, do use to temper their Colours with one part of fat oyl, and two of common Linseed oyl, and by this meanes they make the Colours dry the sooner : this fat oyl is only Linseed oyl exposed to the weather, and so it becometh thicker, yet somtimes you shall see it so thick, that you may cut it almost like butter. It may bee made by boyling the oyl awhile, but the former is the better ; if your Cloth have any knots on it, or uneven threds, then weare them off by rubbing it with a fine pummice stone.

Flesh colour.

Take white Lead, grinde it with oyl, Lake, and Vermilion, so you may make it pale or high coloured, at your pleasure.

White.

Whiting is a white to white Boards only, but white Lead ground with Nut-oyl, maketh a perfect white.

Black, Lamp black, Printers black.

Lamp black is a good black ; the black Earth that the Printers that print Maps and copper plates, is far better ; but for velvers, Hart's-horn black, or Ivory black are the best, and it is thus made.

Hart's-horn or Ivory black or velvet black.

Take Hart's-horn, or Ivory, burn it to coales, and then grind it with oyl. It is made by burning Hart s-horn in a Crucible close stopt that the Ayer come not in, for halse an hour, afterwards ground and washed.

Charcoal black.

Charcoal black is good to shadow Ruffes, or Linnens, and it is thus made ; grinde charcoales very small with water, let it dry, and then grinde it with oyl.

Seacoal black.

Seacoal black serveth for divers uses, as Hart's-horn black cloth, and it is made as charcoal black is.

A false bleu.

Bleu of Inde is to make a false ground for a bleu, and it must be ground with oyl.

Azure bleu, Byce bleu.

Azure bleu or Smalt must never be ground nor your Byce, but they must bee tempered with your knife upon the pallet.

Red, red Lead, Vermilion, Lake.

Red Lead is a good colour to lay under gold, vermillion is a Crimson colour, Lake is the best blood colour.

A hayr colour.

Umber is a hayr colour.

Yellow, Masticot, Orpiment, Gambaugium.

Masticot is a perfect yellow, when you grinde it, you must rub it very lightly, else it will lose the colour ; also Orpiment and Gambaugium are both very good yellows.

Green Verdigrease.

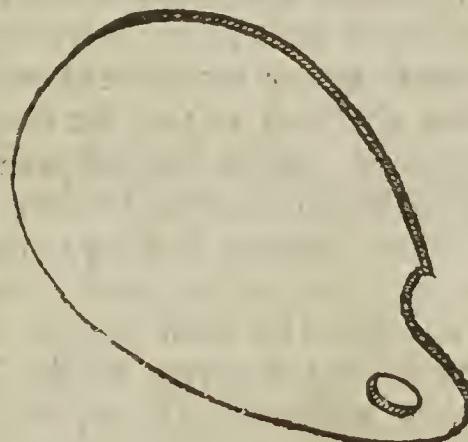
Verdigrease is a good green, and it is usually mixed among your blacks, to make them dry.

Yellow, yellow Oker, reddish.

Yellow Oker maketh a bright hayr colour. Brown of Spain maketh a kinde of reddish colour.

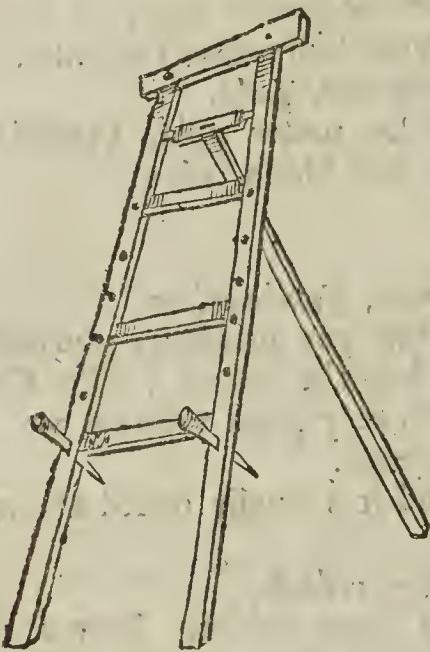
Red Lead and Verdigrease are drying colours, for being mixed with others that of themselves will not dry, they make them for to dry.

The figure of
the Pallet to put
your Colours
upon.



How to order your Colours upon your Pallet.

For the drawing of a Picture you must first lay your single colours in order upon your Pallet thus; a little white Lead, a little Vermilion, a little Lake, so Tauney colour, or Sea-coal black, Oker, Verdigrease; then your Byces for your Bleus, Yellows, and other colours, at your pleasure, each apart: when you have so disposed them, make your mixtures under them.



You must have a Frame made with a stay upon the back, to set it higher or lower; and it must have divers holes in the two former Rayls of it, and there must be two pins, on each fide one: this Frame is called by Artists an Easel, and it is to place your Board or Cloth nayled on a Frame that you intend to work upon, for the more convenience of working it, and ease to the workman.

Now followeth the manner of mixing and laying your Colours.

How to temper and lay your colours upon a Picture.

First you must begin with the white of the Eye, and for it you must temper Charcoale black with white Lead, then lay a carnacion or flesh colour over the Face, and for to make this, you must temper white Lead with Lake and Vermilion; then shadow the Face as you see cause, and make the Nose at your pleasure; draw the compasse of the Nose with some dark reddish shadow, then shadow your Cheeks and Lips; with the stroak between the Lips, with Vermilion and Lake: if need require, you may lay it with white, or some light shadow, but the stroak between the lips must be all Lake, or most of it; then make the circles of the Eyes: for a gray ey, mix charcoal black with white Lead, the brighter you will have

it,

it, put the more white Lead ; the sadder, the more black ; for the black circle of the Eye, Lake, Umber, Seacoal black, and a little white, mix them according to discretion ; to make the round black in the midst of the Eye, mix Lamp black with Verdigrase ; for the hands, you must first lay them with flesh colour, as the Face, and shadow the veines with the same shadowes, making the shadowes between the fingers, somewhat sadder, and the knuckles somewhat redder with Vermilion and Lake : go over the nayles with a light stroak of white, and shadow them above with a dark flesh colour shadow, somewhat sad : if you would have your flesh colour to look any thing yellow, you may put a little yellow oker to it, and make it as much or as little as you will : for a black or swarthy colour or complexion, you must make it as it followeth ; mix Vermilion, white Lead, Lake, and yellow Oker, the browner you will have it, put the more Umber into the shadowes, make the shadow of Umber and Seacoal black.

For the Hayr and Teeth.

For black hayr take Lamp-black, and where you would have it brighter, mix it with Umber, and white Lead, and red Lead : for flaxen hair, take Umber and white Lead ; the browner, the more Umber ; the brighter, the more white ; yet if you will have it a little brown, mingle a little Sea-coal black with it : for yellow hair take Masticot, Umber, yellow Oker, and a little red Lead ; the redder you will have it, put to the more red Lead and Umber : for white hair take half Ivory-black, and half Umber, temper them with your Knife, with white Lead ; the whiter you would have them, put to the more white ; the darker, the more Umber and Ivory.

For the Teeth take white Lead, and shadow it with Charcoal black.

Colours for Apparel.

For Linnen.

For Ruffs take Charcoal black, and mix it with white Lead, make it darker or lighter at your pleasure ; but when you make

your Lace on Ruffs, Cuffs, or such like, you must put to it a little Oyl and Smalt; you must remember (as I have already told you) to temper all your colours for Linnen with Oyl of Nuts, for Linseed Oyl will turn yellow.

For Velvets.

For black Velvet take Lamp-black and Verdigrease, for your first ground; when that is dry, take Ivory-black, and Verdigrate; shadow it with a little white Lead mixed with Lamp-black.

For green Velvet take Lamp-black and white Lead, and work it like a Russet Velvet, and let it dry; then draw it over with Verdigrease tempered with a little Pink.

For Sea-green Velvet take onely Verdigrease, lay it over the foresaid Russet: if you will have it a Grass-green, put a little Masticot unto it; you must shadow these Greens in Russet; for the lighter or sadder you would have your Green to be, you must first lay your Russet accordingly.

For red Velvet take Vermilion, and shadow it with brown of Spain; where you will have it darkest, take Sea-coal black and brown of Spain to shadow among the foresaid colours; let it dry, and then gloss it over with Lake.

For crimson or carnacion Velvet take the more or less white Lead to the Vermilion at your pleasure.

For bleu Velvet take Oyl and Smalt.

For yellow Velvet take Masticot and yellow Oker, and where you will have it darkest, shadow it with Umber.

For tauney Velvet take brown of Spain, white Lead, and Lamp-black; mixt with a little Verdigrease, to shadow where there is occasion; when it is dry, gloss it over with Lake and a little red Lead.

For purple Velvet take Oyl, Smalt, and Lake, of each a like proporcion, temper them together with white Lead, bright or sad it according to your discretion.

For Ash-colour Velvet take Charcoal-black and white Lead, lighten it as you please with white Lead; you must temper a colour like unto a dark Russet, and this will be an Ash-colour.

For hair coloured Velvet take Umber ground of it self, and where your glafs shall be brightest, mix some white Lead, and

and where you make the folds about the edges, lighten or darken it with white Lead and Umber.

Note that when you work Velvet, you must at the first work it somewhat sad, and then give it a sudden brightnesse.

Sattens.

For black Satten take Lamp black, and grinde it with Oyl, and then temper it with white-Lead, and where you will have it to shine most, mix a little Lake with the white-Lead.

For white Satten take white-Lead, and grinde it by it self, also grinde Ivory black by it self; these you must temper lighter or darker according as you would have your Satten shew.

For green Satten take Verdigrease, and grinde it by it self, then mix some white-Lead therewith, and where you would have it shew brightest, ad some Pinck to it. If you would have it more Popingey ad more Pinck to your white-Lead; where you would shaddow it deepest, ad more Verdigreas.

For yellow Satten take Masticot, and grinde it by it self, yellow Oker by it self, and Umber by it self; where you would have it brightest, use Masticot alone, where you would have a light shadow, let Oker serve; where darkest, take Umber; you may mix them at pleasure, but where you will have the sadest shadow use Umber onely.

For bleu Satten take Oyl, Smalt, and white-Lead, mix them, where you would have it saddest, use Smalt, where lightest, use white-Lead.

For a purple Satten lay Smalt alone, and where you would have it brightest, use white-Lead.

For Orange tauny Satten take red-Lead, and Lake, where you will have it brightest, use red-Lead, and where saddest, use more Lake.

For red Satten grinde Brown of Spain by it selfe, mix it with Vermilion, and where it shall be brightest, mix white-Lead with your Vermilion.

For hayr colour Satten mix Umber and white-Lead, where you will have it shew brightest, put more white-Lead, and where you will have the cuts most shadowed, use a little Sea-coal black with your Umber.

For Taffaties.

You must make your Taffaties as you do your Sattens, laying
Z 3

ing the changeable Tassaties thus : take divers colours, as you shal see best, and lay them one by another upon your work, and so shadow them with another, and work them finely one amongst another, at your pleasure.

For Cloth.

It is in a manner all one to make Cloth and Satten, but you must not give your Cloth so sudden a shining glosse. To make Cloth of Gold, take brown Oker and liquid Gold, water and highten upon the same with small gold stroaks.

For Leather.

For Buffe take yellow Oker and some white Lead, work it, and where you would have it dark by degrees, mix it with a little Vmber, and when you have wrought it all over, take a broad Pencill, and size it over with a little Vmber, and Sea-coal-black.

For yellow Leather take Masticot, and yellow Oker, and Vmber to shadow it more or lesse at your pleasure.

For black-Leather for shooes take Lamp black, and shadow it with white-Lead more or lesse.

For Metals.

For yron take Lamp-black well tempered with white-Lead; if you will have it dun or rusty, take some Seacoal-black, and mix it with a little white.

For Silver take Charcoal black and white-Lead, and where you will have it darkest use more Charcoal, and work your Silver somewhat rustish then give it a sudden glosse with white Lead only, where you think good.

For Gold take Lake, Vmber, red-Lead, and Masticot ; these are the colours for Gold ; you must lay the ground with red-Lead, and a little dry Pinck, if you please ; where you will have it darkest, shadow it most with Vmber, and where lightest, with Masticot.

Note; that when you grinde your red Lead to make your Gold Size, you must put a little Verdigrease into it, to make it dry the sooner.

For Pearles.

For to make Pearles you must temper Charcoal-black with white-Lead, untill it become a perfect Russet ; then make your Pearl with it : and give it a speck of white-Lead, onely to make it

it shine: note, that the glizingen Ceruz which was mentioned in the Art of Limming, being tempered with Oyl of white Poppy, is most excellent to highten up pearles.

For precious Stones.

To make Carbuncles, Rubies, &c. you must first lay theyr counterfeit grounds, then with transparent colours, (such as are Lake, Verdigrease, and Verditer) give them a shining glossie.

For Fier

For Fier where it is reddest, lay red-Lead, and Vermilion tempered together; where the flame is bleu, take Oyl, Smalt, and white-Lead; where it is yellow, take Masticot, and work it over in some places, where you will have it shine most, with Vermilion, yet so as your Vermilion may appear.

For the Skie.

Take Oyl and Smalt, mix them with Linseed Oyl on your pallet; you must not grind it at all, (for then it will lose its colour) temper it with white-Lead only, as bright as you will have it, and where it looketh red, use Lake with your white-Lead, and Smalt..

For Wood.

For some kindes of Wood you must take Lake, Vmber, and White; for others, Charcoal and White; for others, Sea-coal and White; for some also, Vmber, Black, White, and a little green: also if your Wood look red, take a little Lake or Vermilion among your aforesaid colours, as you shall think best.

How to wash your Pencils.

Take a deep drinking Glasse, and fill it half full with clean Linseed oyl, then put your Pencils that you have wrought with Oyl, into the same, and rub their brush ends against the sides of the Glassee, and the Oyl will loosen the colour from off them, which will sink to the bottom of the Glassee; you may use these settled colours for to prime your Cloth and Boards.

How to preserve your Oyl colours, and keep them from drying.

Put each colour by it self in little Pans or Pots, and set them in the water that they may be covered over therewith, and they will keep moyst a great while, that you may work with them at your pleasure, other wise they will dry quickly, and being once dry, will never be tempered again to work with.

Payntings must bee placed in their proper places , with their shadows from the light.

Of distempering or working in great with water colours.

This kinde of work is all one with paynting in Oyl, sauing that the colours are tempered with Gum-water, or Size : it is more speedily performed, but the colours will not continue so fresh as in Oyl.

To make Colouring called Vernix : to vernish Gold, Silver, or any other colour on Vellom, Paper, Timber, Stone, &c.

Take Bengewin, and bray it well betwixt two Papers, then put it into a Violl, and pour on it aqua vitæ, that it may stand above the Bengewin three or four fingers, and let it steep so a day or two ; then put to it for half a Violl of aqua vitæ five or six Chieves of Saffron slenderly stamped ; this done, strain it, and with a Pencill vernish therewith any thing gilded, which will become bright and shining, drying it self immediatly, and will continue the brightness many yeares ; but if you will vernish on Silver, then take the white that is found in Bengewin, and dresse it with aqua vitæ as afore, leaving out the Saffron, and the sayd Vernish made with these only, is very good to vernish all things, as well painted as not painted ; for it maketh Tables of Wal-nut Tree and Hebene to glister if it be layd on them, and all other things, as yron, Copper, or Tin gilded, or not ; it maketh bright, preserveth and aydeth the Colour, and dryeth incontinent without taking dust.

How to paynt Glasse.

There are two manner of wayes of paynting upon Glasse : the one is for Oyl colour, the other for such colours as are afterwards to be annealed or burnt on. First of the first.

How to lay Oyl colours upon Glasse.

First you must grinde your colour with Gum-water once, and afterwards temper it with Spanish Turpentine ; lay it on, and let it dry by the Fier and it is done.

How

How to paint Glasse with Colours, and to anneal them.

There are six principall Colours used in paynting Glasse, whereof divers others may be made by mixing some with other ; the names are these, Yellow, White, three Blacks, four Bleuſſ, three Reds, and ſix Greens ; the making whereof followeth in order.

Yellow,

Take an old Groat, or any other piece of the Pureſt refined Silver, then take a quantity of Brimſton, and melt it, and then put your Silver unto the melted Brimſton, and with a payr of ſmall Plyers take it out again, and light it in the fire, hold it in your plyers untill it leave burning, then beat it to Pouder in a brazen Morter, afterwards grinde it on a Marble with Gum-arabick water, and a ſmall quantity of yellow Oker ; work with this what you will upon Glasse, and let it dry of it ſelf.

Another fairer Yellow

Take a quantity of good Silver, cut it into ſmall peices, take then twice ſo much Antimony beaten to Pouder, put them together in a ſmall Crucible, and ſet it in a hot fire for the ſpace of half an hour, then take it out of the fier, and caſt it into any brasse thing, and afterwards beat it into Pouder. Note that you muſt weigh the Silver before you burn it, and weigh ſix times as much yellow Oker, and ſeven times the weight of old Earth that hath been ſcraped off yron annealed work, grinde all very well together with your burnt Silver, put it in a Pot, ſtir it well, and ſo uſe it.

White.

This Colour is the Glasse it ſelf, and it may ſerve very well without any other Colour ; you may diaper upon it with other Glasse or Chrystal ground to Pouder.

Black.

Take Jet and the ſcales of yron, and with a wet feather take up the ſcales that fly from the yron after the Smith hath taken a heat ; these ſcales you muſt grinde on a Paynters ſtone with the Jet and Gum-water, to be uſed as the former Colours.

Another Black.

Take a quantity of Yron ſcales, as many Copper ſcales, ſtamp them ſmall, and make them red-hot in a clean fire-shovell, then take half as much jet as one of them ; firſt grinde them ſmall,

A a temper

temper them with Gum-water, use them as the aforesaid.

Bleu, red, and green.

These three colours are to be used after one manner ; provide beads, the clearest that you can get, of the forenamed colours, beat them to powder in a brazen morter, each colour by it self, then buy some Amel at the Gold-smiths of the same colours, which must also be very clear and transparant, grinde each by it self, then take two parts of Beads, and one part of Amel, grinde them together, as you did your Silver.

Another fayr Red.

Take a quantity of Dragons bloud, beat it to powder, and put it into a Linnen-cloth, and put thereto some rectified Spirit of Wine, cover it close a little while, and it will grow tender; then wring it out into a Pot, so the clear will come, and all the dros will remain in the Cloth, so you may use it when you need.

A fayr Carnacion.

Take an ounce of Tyn-glass, three ounces of Jet, five ounces of red Oker, Gum a quarter of ounce, grinde them together, and use them.

Another Carnacion.

Take a quantity of Jet, half as much Litharge of Silver or glass-tyn, half as much iron-scales, as much Gum, and as much red chalk as all the rest do weigh, then grinde them, and use them.

Another excellent Green.

Take a quantity of Verdigrease, grinde it well with Turpentine, when you have so done, put it in a Pot, and when you use it, warm it on the fire.

How to anneal or burn your Glass, to make the Colours abide.

You must take Bricks, and make a Fornace four-square, one foot and a half broad, and a foot and a half high ; when you have so done, lay divers little barrs cross the top of it, five or six, or as many as you shall think fitting, then raise the Fornace a foot and a half high above the bars, and it is done ; you must have a plate of iron to lay all over the bars.

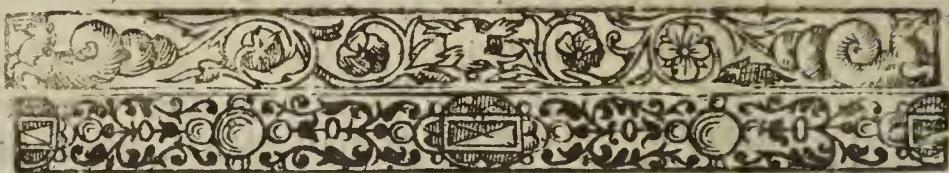
Herr.

How to place your Glass in the Fornace.

Take slaked Lime, and sift it through a sieve upon the plate, then lay a row of glass upon that bed of Lime, then sift another bed of Lime, and lay another bed of glass upon it, this do until your Fornace be full, lay also with every bed of glass a piece of glass which you may wipe over with any colour; these are called watches, for when you think your glass is sufficiently enough burnt, then with a pair of pliers take out the first and lowest watch, lay it on a board, and when it is cold, try if you can scrape off the colour, if it hold fast on, then you may take out that row, but if the colour scrape off then it may abide the fire longer.

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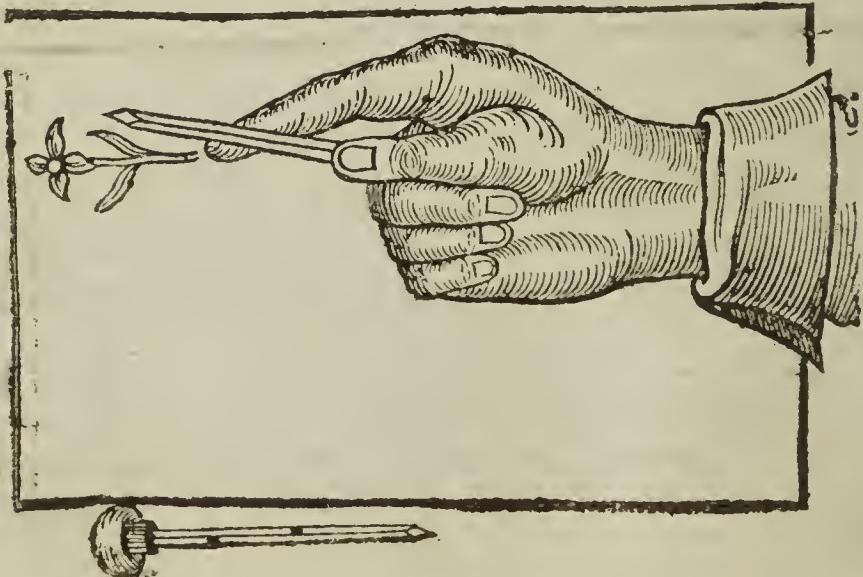


Of Graving.

Si T is possible for one to be a good Painter; & yet not to be able to draw well with the Pen, because there is not required in a Painter such a curious and exact carriage of the hand: but it is impossible for one ever to Grave or Etch well, except he can draw well with the Pen. First therefore, presupposing you can do the first before you attempt the second, you must provide divers graving tools, both long and short; some for hard work, some for sweet work; some for smaller work, and some for greater: also a piece of a Beaver-hat, and a good Oyl-stone, smoothed on one side, and free from pin-holes, and plates of Copper or Brass exactly polished:

Of Gravers.

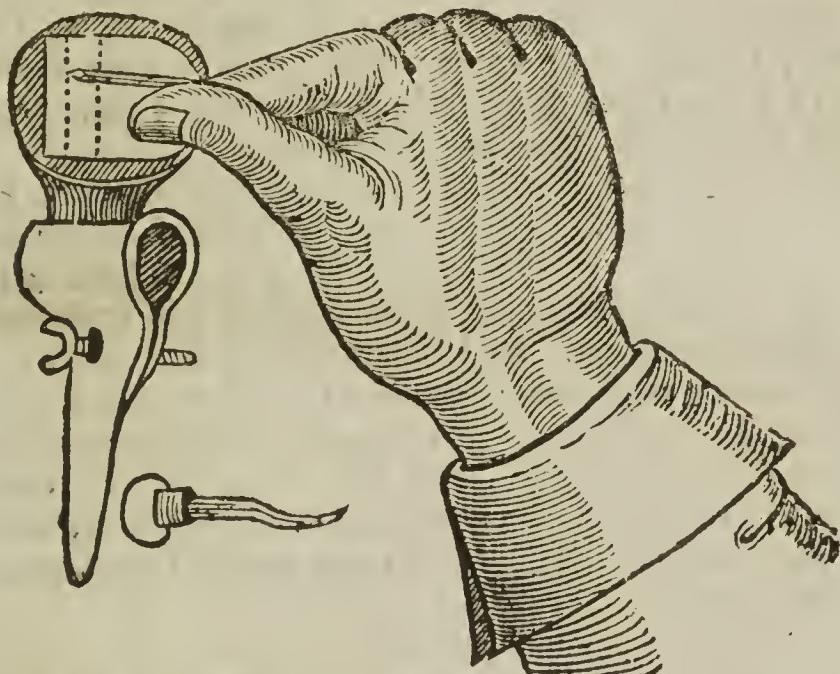
There are two principal sorts of Gravers, the long and the short: the long are straight, and for to engrave plates withall, especially the greater; and these are to be held as the figure following doth expres; where you may note that the pummel of



the

the Graver resteth against the ball of the thumb, and the point is guided with the fore-finger. And there ought to be a little bag of sand under your plate, to the end that you might turn your plate upon it, as your work doth require.

The second sort is a short Graver, and turneth up somewha at the end, and that is to engrave Letters and Scutcheons in plate-seals, and smaller plate, being fastned in some convenient



instrument: this must be held likewise according unto the expression of the figure foregoing; where it is to be noted, that the pummel of the Graver is staid against the farther part of the hand, and is guided by the inner side of the thumb. It were needfull that there were a piece of Leather like a Tailors thimble, about the end of the thumb, waxed or gleued, whereby to guide the Graver more steaddily, and stay it upon occasion.

How to make Gravers.

Provide some good Cross-bowe steel, and cause it to be beaten out into small Rods, and softened: then with a good file you may shape them at your pleasure; when you have done, heat them red hot, and dip them straight down into Soap, and by so doing, they will be hard indeed. Note, that if in dipping of them into the Soap, you turn your hand never so little awry,

The Graver will be crooked. These Gravers made and hardened after this manner, do far exceed all the other Gravers.

If your Gravers be too hard, heat them a little, and thrust them into tallow, and they will be tougher.

The oyl stone is to whet your Gravers on ; drop one or two drops of sallet oyl upon it, and whet your Graver thereon, and it will have an edge presently.

How to smooth and pollish Copper plates.

Because that in the printing with copper plates, the least scratch, though it be scarce visible, receiveth its impression, and so many times disgraceth the work : I have set down a way to smooth plates for impression.

First, take a peece of brasse or copper, of what bignesse you intend, of an indifferent thicknesse, and see as neare as you can, that it be free from fier flaws : First beat it as smooth as you can with a hammer, then rub it smooth with a pumice stone that is void of gravell, (lest it race it, and so cause you as much more labour to get them out) burnish it after with a burnishing yron, having first dropped a drop or two of sallet oyl on it ; then rub it over with a coal, prepared as is after taught ; and lastly with a peece of Beaver hat dipt in sallet oyl, rub it very well for an houre : thus you may pollish it exactly.

How to prepare your Coales.

Take Beechen charcoal, such as when they are broke, do shine; such as are void of clifts, and such as break off even : burn them again, and as soone as they are all through on fier, quench them in chamber ly ; after take them out, and put them in fayr water, and reserve them for your use.

Having prepared all things in a readinesse, you must have a draught of that you intend to cut or engrave.

Take the plate then, and wax it lightly over, and then either pounce the picture upon it, or trace it, or by drawing over the lines of the picture with ungummmed inke, reprint it upon the plate ; then work upon it, observing the shadow, so that being printed, it may stand right; for it will be backward upon your plate ; when you have cut one stroke, drop a little sallet oyl upon your peece of Beaver, and rub over the said stroke, for by this meanes you shall better see the stroke

stroke, and how to cut the next equall unto it, and so the rest proportionally distant one from another ; but to work by a candle, you must place a glasse of fayr water between the candle, and a paper between that and the plate, (which casteth a true light) or you will never be able to work truly and aright.

Of Etching.

Etching is an imitacion of Engraving, but more speedily performed. Things may bee expressed to the life thereby, but not so sweetly as by the Graver. It is thus performed ; the plate you are to etch upon, must first exactly be polished, afterwards overlaid, but very lightly, wtih a ground made for the purpose, (of which anon) and thereupon must be pounced, drawn, or traced, the thing chat you are to etch ; then the said ground is to bee pierced with divers stiles of severall bignesse, according as the shadowes of the picture do require ; afterwards the edges of the plate are to be raised with soft wax, and strong water (for so they terme it :) (it is to be had at the signe of the Legge in Foster lane a Distillers) is to be put upon it, which in those places where the strokes are required to be lightly performed, is to bee abated or alayed with fayr water, which having dured awhile upon the plate, will eat into it, as it were engraven, then put it into cold water, and wash it about, and it will leave eating further, and then take off the ground, and it is done.

A red ground for Etching.

Take red Lead, grinde it very well, and temper it with Vernish.

A white ground.

Take one ounce of Wax, and two ounces of Rosin, melt them together, and add thereto a quarter of an ounce of Venice ceruse ground fine, lay it on while it is hot.

A black ground.

Take Asphaltum two parts, Bees wax one part ; melt them together, and being warm, lay it on very thinly with a fine lawn rag. If it seeme somewhat red in any one part, hold it over the smoak of a llink or wax candle, and it will be amended. Note, that it is a principall thing in this Art to lay the ground on aright.

Another

Another Way how to Engrave with water.

Take Verdigrease, Mercury sublimated, Vitreoll, and Alum, a like quantity, beat all to pouder, put them into a glasse, and let it stand so halfe a day, and stirre it often, then lay on the plate wax mingled with Linseed oyl, or red Lead with Linseed oyl, and write in it that you mean to grave, then put the water on it, and let it so remain halfe a day, if you will have it very deep, let it lie longer. If you will engrave Images, &c. lay the wax on the yron or steele, thin, and draw what you will thereon, that it may touch the metall, then put the water into the strokes, and it will be engraven.

How to engrave on a Flint stone.

Take a Flint, and write on it what you will, with the Fat or Tallow of an Ox, afterward lay the Flint in Vineger four dayes.

The manner of engraving in Wood.

The Figures that are to be carved or graven in Wood, must first be drawn, traced, or pasted upon the Wood, and afterwards all the other standing of the Wood, except the Figure, must be cut away with little narrow pointed Knifes made for the purpose.

The working is far more tedious and difficult than the working in Brasse : first, because you must cut twice or thrice to take out one stroak, and when you have cut it so that it may be pickt out, yet if you have not a great care in picking it out, you may break out a part of your work, which may deface it : Secondly, because that in crosse Hatches you must stand picking, so that it would weary one to see ones w^rork go so slowly on ; yet a good resolucion may in time overcome these and other difficulties that attend thereupon ; and for those inconveniences an Artist may finde in the practise thereof, this is one Commodity he shall gain ; he shall be private in his designes, for he himself may print them when they are cut ; nor shall they be exposed to the veiu of every Stacioner that frequent upon all occasions the housen of common workmen, whereby one receiveth much injury and vexacion.

Of the Choice of Wood to cut in :

Box is the best ; but Walnut Tree, Beech Maple, or any hard, close, and well seasoned Wood may serve : let it be cut out and plained inch thick, and in peices according as the bignesse of your Figures do require.

of

Of drawing your figures upon the Wood.

First grinde some white Lead very fine, and temper it with fair water, and then dip a cloth in this misture, and rub over one side of your Wood, and let it dry thorowly; this keepeth the Ink (if you draw on it therewith) that it run not about, nor sink; if you draw with Pastils, it maketh your strokes appear more plainly and brightly.

Of tracing your figures upon wood.

Having whited one side of your Wood, as before, black or red the blank side of your figure, as I have taught in the Art of Painting, and with a little stick or Swallows quill trace or draw over the strokes of your figure.

Of pasting your figures upon wood.

Note, that you must not white over the Wood when you intend to paste the figures, for that will make that your figure shall pill off, onely see the Wood be well plained, then wipe over the drawn or printed side of your figure with Gum-tragant dissolved in fair water, and clap it even and smooth upon your Wood, and let it dry throughly; then wet it a little all over, and fret off the Paper gently, untill you can see perfectly every stroke of your figure; then let it dry again, and when it is throughly dried, fall to cutting or carving it; beware you fret not the figure away in any part when you are fretting it.

The manner of printing your wooden Pieces.

In the following Part of Extravagants, I have taught how to make printing Ink of sundry colours, to which I refer you; you must have also some Wooll bound up in a piece of sheeps leather, also a Rouler, smooth and even, which must have a piece of Cotton-bays rouled hard twice about it; first wet the Paper you would print upon, with a Sponge wet with Allum-water, then take some of the kindes of Ink, and put it upon the Leather, and lightly clap it all over the Print, then put the Paper that you wet, upon it, and roule it hard on with the Rouler, and it is done.

F I N I S.

Bb

the garden, and the flowers are to be seen in the distance, and the birds sing in the trees, and the bees fly about the flowers, and the butterflies flutter among them, and the insects crawl upon them, and the worms burrow in the soil, and the roots of the plants penetrate the earth, and the leaves of the plants receive the sun's rays, and the flowers are pollinated by the bees, and the seeds are dispersed by the wind, and the plants grow and flourish, and the garden is a beautiful sight.

The garden is a place where we can grow our own food, and where we can have fresh vegetables and fruits, and where we can have a variety of flowers and plants, and where we can have a peaceful and quiet place to relax and enjoy the beauty of nature.

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EXTRAVAGANTS

Wherein (amongst others) is principally con-
tained divers excellent and approved

Medicines for severall Malladies.

By JOHN BATE.



LONDON,
Printed by R: Bishop for Andrew Crook, at the Green
Dragon in Pauls Churchyard. 1654

To the Reader.

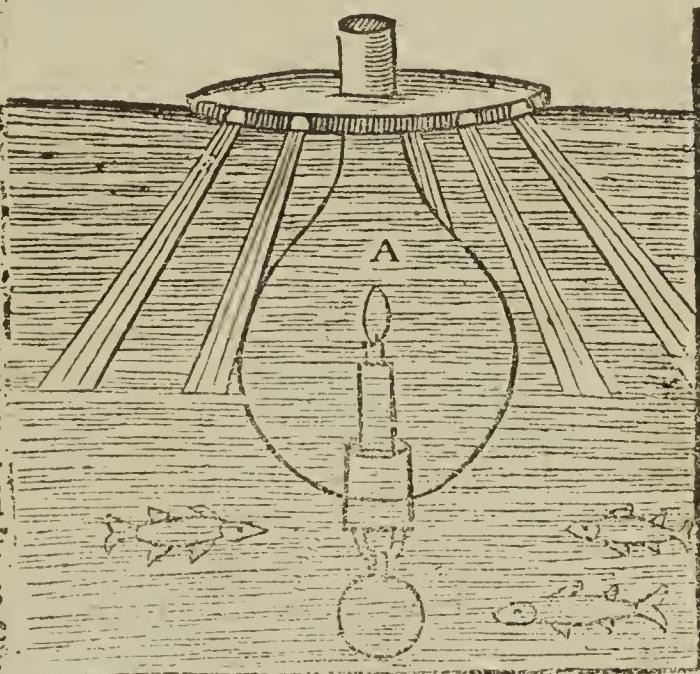
Courteous Reader, forasmuch as there were divers Experiments, that I could not conveniently, or rather my Occasions would not permit me to dispose in such order as I would have done, I thought it would not be amiss to call them by the names of Extravagants, and so to set them down as I found them, either inserted amongst other my Notes, as I put them in practise, or as they came into remembrance. I would have been more corious in Chirurgical Experiments, because I have always much delighted therin, and have both seen and made much experience thereof; but having considered with my self, that those things would best suit with themselves, and be acceptable unto every one, I have purposely made a reservation of some, which accordingly as I shall perceive them to be affected, I shall, if God permit, present you with in a peculiar tractat hereafter.



Extravagants.

*How to make a Light burn under the water, being a
very pretty conceit to take Fish..*

Let there be a Glass, as A, having a hole at the bottom, to put a Candle in with a screwed socket. The socket must have a Loop at the bottom, whereunto you must hang a weight of such heaviness, that it may draw the body of the Glass under water. The neck of this Glass must be open, and stand above the water; also about the neck must be fastened a good broad piece of Wood; and round about which (but on that side of it which is next unto the water) must be placed divers pieces of Looking-glasses; so the light of the Candle in the glass body will be multiplied according to the number of them. All the fishes near unto it will resort about it, as amazed at so glorious a sight, and so you may take them with a cast-net or other.



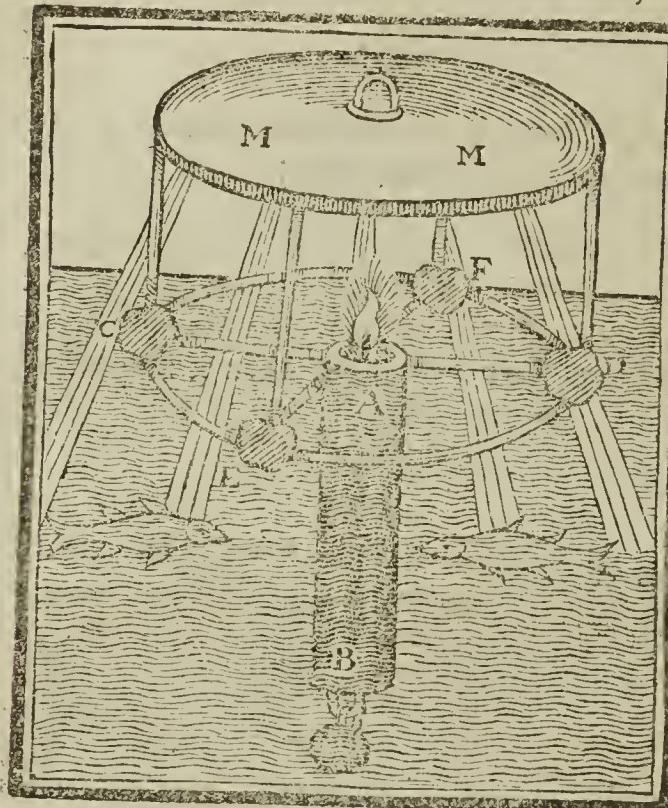
B b. 3.

Another.

*Another pretty Conceit for the same purpose, but more
easie to be made, and with less cost.*

Provide a piece of Wood turned hollow like unto a Poking or steel-stick, as A B, in the top of this Wood at the sides of it let there be fastened four little sticks, or rather pieces of Wyer,

which may pass thorou four pieces of Kork, as C D E F, and so turn up, and be fastned again in a thin light piece of board, as M M, in which board must be fastned a great Looking-glass, if you would make one great Light; but divers little pieces, if you desire a multiplication of Lights, and upon the top of this board let there be fastned a loop of iron to let it into the water by means of a



Pole with a Hook at the end of it, and at the bottom of the turned wood let there be tyed a waight or stone of sufficient bigness. Thorou the Korks C D E F, there ought to be drawn another Wyer quite round, and to be bound fast unto the former Wyers, and it is finished. When you would occupy it, fill the Wood A B almost full of water, light a Kandle and put into it, and it will swim in it, and so burn leisurely; then place it in a Pond or River, with a Hook, and the Light will be dispersed in a great compafs about the water.

How to make an Image hang in the middle of a Glass.

Make the lower part of the Image of hard Wax, and the upper part of it of Wood, and over-lay it with Oyl Colours; then put it into a Globe-glas filled with fair water, and which way

way soever you turn the Glas, the Image will still hang in the middle, and stand as it were upright; which, to my knowledg, hath been a thing causing no small admiration among divers that have not understood the cause of it.

How to make five or six Dice of the ordinary bigness of Dice, such as you may game withall, and such as would be taken by their looks to be ordinary Dice, and yet all of them to weigh not above one Grain.

Take a piece of Eldern and pith it, lay the Pith to dry, and then make thereof with a sharp knife five or six Dice, and you shall finde it true that I have said.

How to lay Gold on any thing.

Take red Lead ground first very fine, temper it with Linseed-oyl; write with it, and lay Leaf-gold on it; let it dry, and polish it.

To lay Gold on Glass.

Grinde Clalk and red Lead, of each a like quantity, together, temper them with Linseed-oyl, lay it on; when it is almost dry, lay your Leaf-gold on it; when it is quite dry polish it.

How to make Iron or Steel exceeding hard.

Quench your Instrument seven times in the blood of a male-Hog, mixed with Goof-grease, and at each time dry it at the fier before you wet it, and it will become exceeding hard, and not brittle: approved.

To make yron as soft as Lead.

Take black flints, pouder them very finely; then put the pouder in an yron pan, and make it red hot, then cast it on a marble stone, till it be almost cold, then make it red hot againe, and let it coole, and grinde it so long till it cleave to the stone, and grinde as it were clay; then put that in a glasse, and set it under the Eaves of a house, where the Sunne commeth not nigh in the day, then the night after take out the water that you shall finde in the glasse above the pouder, then take that pouder and grinde it with the water, and put it in a stillatory, and let it still out the halfe; afterward pour the water againe on the said pouder, and still it againe with a soft fier; then take and seethe that water till the halfe be wasted,

wasted, then take some iron blade of a knife that is new broke, and put it together, and hold it so a little while ; then take of the water which was sod to the halfe, and with a feather lay it first to the one side of the blade, and when the water is cold, lay it on the other side, and it will soder fast with this water ; and with this water you may make steel as soft as Lead. It is likewise a sovereign water to help the Gout, being anoynted where the grieve is, for it giveth ease very speedily.

To colour Tyn, or Copper, &c. of a golden colour.

Take Linseed oyl, set it on the fier, scum it clean, then put therein of Amber, and Aloe Hepaticum, a like quantity, then beat and stirre all well together with the oyl till it wax thick ; then take it off, and cover it close, and set it in the earth three dayes : when you would use it, strike your metall all over therewith, and so let it dry, and it will be of a golden colour.

To gild Iron with a water.

Take running water 3 pound, Roch-allum 3 pound, and Roman Vitreol one ounce, of Verdigrease one penny weight; Saltgem three ounces, Orpiment one ounce, boyle all these together, and when it begins to boyle, put in Lees of Tartar and Bay-salt, of each halfe an ounce, make it seethe, and being sod a pretty while, take it from the fier, and strike the Iron over therewith, then let it dry against the fier, and then burnish it.

To soder on Iron.

Set your joynit of Iron as close as you can, then lay them so in a glowing fier ; then take of Venice-glasse in fine pouder, and the Iron being red hot, cast the pouder thereon, and it shall soder of it selfe. If you clap it in clay, it will be the surer way.

To gild on Iron or Steele.

Take one ounce of Argall, three drammes of Vermilion, and two drammes of Bole-armoniack, with as much Aquavitæ, then work and grinde them all together on a stone, with Linseed-oyl ; having so done, put thereto *Lapis Calaminaris* as big as a Hazel-nut, and grinde therewith in the end three or foure drops of Vernish ; take it off the stone, and

and strain it thorow a linnen cloth into a stone pot, (for it must be as thick as honey) then strike over your iron therewith, and let it dry, and then lay your gold or silver on, as you would do upon the Vernish.

A vernish like gold, for tyn, silver, or copper.

Take small pots well leaded, then put therein six ounces of Linseed-oyl, one ounce of Mastick, one ounce of Aloes Epaticum ; make them altogether in fine pouder, and then put it into your said pot, and cover it with such another ; yet in the bottom of the uppermost pot make a small hole, wherein put a small stick with a broad end beneath, to stir the other pot withall, and when the pots are set just together, close them all about with good clay, and cover them all over also, leaving the hole open above to stir the other pot with the stick ; set it over the fier, and stir it as often as it seetheth, and when you will gild, pollish your Metall over first, and then strike this over the Metall, and let it dry in the Sun.

How to melt Metall very quickly, yea in a shell upon the fier.

First make a bed or laying of Metall, and upon it make another bed with pouder of Brimston, Saltpeter, and Sawdust, a like quantity of either, then put fier to the said pouder with a burning charcoal, and you shall see that the Metall will dissolve incontinent, and bee in a masse : approved.

*How to colour pollished iron of a fine Reddish, Bleuiss,
or Blackiss Colour.*

Take your iron after that you have pollished it, and heat it a little, and then rub it over with some Dragons blood purified, and it will be of a fine transparant colour : a bleu colour may bee brought upon iron or steel burnished, by laying it upon quick charcoal, blowing them lightly untill you see the colour come upon your iron, then take it out presently ; or by heating your iron first, and then rubbing it over with a woollen cloth dipt in Endego ground and tempered with Sallet oyl ; this bleu is proper for Costlets, Muskets, and such like, the former for smaller wortk. If you would have a black colour on iron, first make it clean, then heat it, and rub it over while it is hot with an old stocken a little wet in Sallet oyl.

To lay Gold on iron or other Metall.

Take liquid Vernish one pound, Turpentine, and oyl of Linseed, of each an ounce, mix them well together ; with this ground you may gild on any Metall, first striking it upon the Metall, and afterward lay on the gold or silver : when it is dry, pollish it.

To make ice that will melt in fier, but not dissolve in water.

Take strong-water made with Saltpeter, Allum, and oyl of Tartar, of each one pound ; infuse them together, then put into them a little aqua ardens, and it will presently coagulate them, and turn them into Ice.

A Cement as hard as stone.

Take Pouder of Loadston, and of Flints, a like quantity of either, and with whites of Eggs and Gum-dragant make Paste, and in a few dayes it will grow as hard as a stone.

To make Paper waved like unto Marble.

Take divers oyled colours, put them severally in drops upon water, and stir the water lightly, and then wet the Paper (being of some thickness) with it, and it will be waved like Marble ; dry them in the Sun.

To make Copper or Brass have the colour of Silver.

Take Sal-armoniack, Allum, and Salt, of each a like quantity, and with a little filings of Silver, let all be mixt together, then put them into the fier, that they may be hot, and when they shall cease to smoke, then with the same powdered and moistened with spittle, rub your Copper or Brass.

How to make Gleu to hold things together as fast as stone.

Take of the pouder of Tile-sheard two pound, unslaked Lime four pound, Oyl of Linseed a sufficient quantity to temper the whole mixture ; this is marvellous strong.

To make a thin Gleu.

Take *Gluten Pisces*, beat the same strongly on an Anvil till it be thin ; after lay it to soke in water, untill it become very soft and tender ; then work it like Paste, to make small rousls thereof, which draw out very thin, and when you will work with it, put some of it in an earthen pot, with a little water, over the embers, and scum the same very clean, and let it seethe a little while, then work with the same, keeping it still over the fier. With this Gleu you may fasten pieces of Glas together.

How

How to make Mouth-gleu.

Take Ising-glass, and steep it in water untill such time as you may easily pull it to pieces, after you have pulled it to pieces, put it into a Glass or Pot well leaded, and set it in balneo, that is, in a pot of water on the fier, there let it remain untill all or the most part of it be dissolved, then strain it thorow a wide hayr-sieve, while it is hot, upon another course and close hayr-sieve, and when it is cold, it will be like a thick gelly, then you must cut it into long handsom pieces, and put all these pieces so cut, on a string, so that they touch not one another, and hang them in the Sun untill they are through dry, and it is made. If you would have it of a dainty smell, and aromatical taste, put into it a little Cynamon bruised, and a little Marjerom, and Rosemary flowers, while it is dissolving, and if you please, a small quantity of brown Sugar-candy, to give it a sweetish smatch.

To make Iron have the colour of Brass.

First pollish it well, rub it after with aqua fortis, wherein the filings of Brass are dissolved: the like may be done with Roman Vitreol dissolved in Vineger and fair water, of each a like quantity, but it will not continue long.

To make Wood or Bone red for ever.

Take the pouder of Brazil, mingle it well with Milk, but so, that it be very red, and put therein either Wood or Bone, letting it ly in eight days, and it will look red for ever.

How with one Candle to make as great a light, as otherwise of two or three of the same bigness.

Cause a round and double Glass to be made, of a large size, and in fashion like a Globe, but with a great round hole in the top, and in the concave part of the uppermost Glass, place a Candle in a loose socket, and at the same hole or pipe which must be made at the side thereof, fill the same with Spirit of Wine, or some other clear distilled water that will not putrifie, and this one Candle will give a great and wonderfull light, somewhat resembling the Sun-beams.

A Cement for broken Glasses.

Beat the whitest fish-gleu with a hammer, till it begin to wax clear, then cut the same into very small pieces, suffering the same to dissolve on a gentle fier, in a leaded pan, with a few drops of

Aqua vita, then let some other that standeth by, hold both the pieces that are to be cemented, over a chafing-dish of coals, till they be warm; and during their heat, lay on the dissolved Glue with a fine penil; then biade the Glass with wyer or thred, and let it rest till it be cold.

An admirable Secret of representing the very form of Plants, by their ashes, philosophically prepared, spoken of by Quertitanus and Angelus Salæ.

Take (say they) the Salt both the fixed and the volatil also. Take the very Spirit, and the phlegm of any herb, but let them all be rightly prepared; dissolve them, and coagulate them, upon which if you put the water stilled from May-dew, or else the proper water of the herb you would have appear, close them all very well in a Glass for the purpose, and by the heat of the embers, or the natural heat of ones body, at the bottom of the Glass, the very form and Idæa thereof will be represented; which will suddenly vanish away, the heat being withdrawn from the bottom of the Glass. As I will not argue the impossibility of this Experiment, so I would be loth to employ my endeavours, until I were expert therein.

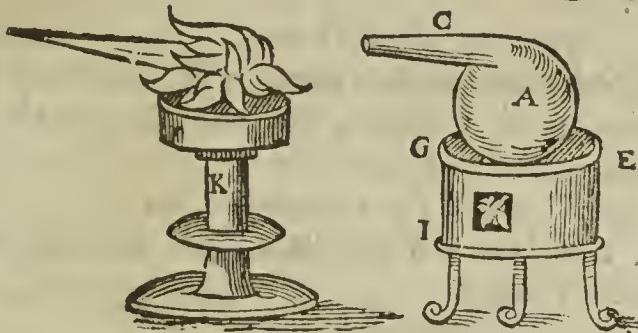
A device how to make Plants to grow in a place which Herbs cannot be transported to be planted, by reason of the distance of the place.

Take what Herb you please, burn it, and take the ashes and put them into a melting-pot, and binde another pot upon it, and lute them well together, and burn them in the fier for the space of two hours, then take out the ashes and pour hot water upon them, and let them stand two or three hours; then drain that water from them, which will be of a saltish taste, then put more warm water unto the same ashes, and after that hath stood awhile, let that also drain away, then put both these waters together, and boyl them gently on the fier, until it be consumed, and in the bottom of the vessel you shall have a kinde of Salt, which take and sow in good ground well prepared, and you shall have your desire. Note also, that the Lixivium or Ly made with water and the ashes of any Vegetable, yea Mineral, or Animal, if it freez in Winter unto Ice, exactly represents the real species whence you made the ashes; which testifies that the form of any thing continues in the Salt after the dissolution of the creature.

A de-

A device to bend Glass-kanes, or make any small work in Glass.

Let there be a vessel of Copper about the bigness of a common Foot-ball, as A, let it have a long Pipe at the top, as C,



which must be made so, that you may upon occasion screw on lesser or bigger vents made for the purpose. Fill this one third part with water, and set it over a Fornace of coals, as E G I, and when the water begineth to heat, there will come a strong breath out of thenose of the Vessel that will force the flame of a Lamp placed at a convenient distance, as K; if you hold your Glass in the extention of the flame, it will melt suddenly; so you may work what you will

thereof. There are that instead of this Globe make use of a Pipe, as D, fastned in a stick, of which I have made use, but hold it not so convenient for those that are not accustomed thereto.

An excellent water for any Morphew, or scurviness in the face.

Take an ounce of quick Sulphur, two ounces of black Sope, the rankest and ill-favoured'st that can be got: binde them up in a cloth, and hang them in a pint of the strongest wine-vineger for the space of nine days; herewith wash the Morphew in

the face or elsewhere, and let it dry in of it self. This water will for the present stain the face with a yellow colour, which will wear away in time.

How to soften Iron.

Take of Allum, Sal-armonick, Tartar, a like quantity of either, put them into good Vineger, and set them on the fier; heat your Iron, and quench it therein.

A good Cement for broken Glasses.

Take raw Silk, and beat it with Glass, and mix them together with the whites of Eggs.

Another.

Take of calcined Flints, quick Lime, and common Salt, of each a like quantity; mingle them all together with the whites of Eggs; then take a Linnen-cloth and spread it over with this mixture, and put it upon the fracture, and let it dry; afterwards anoint it with Linseed-oyl.

How to cause that the same quantity both of Powder and Shot discharged out of the same Piece shall carry closer, or more scattering.

Take the quantity of a Pease of Opium, and charge it amongst the shot, and this will make the shot to fly closer together than otherwise it would. This I had of a Sea-man, who had made tryal hereof, as he said, and unto whom I sold some for the same purpose; and it is very probable, for it is of a congealing and fixative nature.

A bait to catch fish.

Take *Coccus Indiæ* four ounces, Henbane seeds, and wheaten flower, of each a quarter of an ounce, hive Honey as much as wil make them into paste. Where you see most store of Fish in the River, cast of this paste into it in divers little bals about the bigness of Barley-corns, and anon you shal see the Fish swim on the top of the water, some reeling to and fro as drunken, others with their belleys upwards, as if they were nigh dead; so that you may take them either with your hands, or a small Net at the end of a stick made for the same use. Note here, that if you put the fish that you thus take, into a Bucket of fair and fresh water, or if it rain after that you have cast this your bait into the water, they will revive and come to themselves to your admiration; and this was told me

me by a Gentleman of good credit, that hath often made use thereof.

I have heard that the stinking oyl drawn out of the roots of polipody of the Oak by a retort, mixed with Turpentine, and hive Honey, and being anoynted upon the bait will draw the Fish mighty thereto, and make them bite the faster : and I my selfe have seen Fishes, as Roches, and taken in the dead time of winter with an angle, bayted only with paste made of wheaten flouer, -but it bath been in the morning, and when the Sunne hath shined.

How to write without Ink, that it may not be seen, unless the Paper be wet with Water.

Take Vitreol, and pouder it finely, and temper it with fayr water in any thing that is clean, when it is dissolved, you may write whatsoever you will with it, and it cannot be read, except you draw it thorow water wherein some pouder of Gals hath been infused, and so it will shew as black as if it had been written with Ink.

How to make white letters in a black field.

Take the yolk of a new-layd Egg, and grinde it upon a Marble with fayr water, so as you may write with it : having ground it on this wise, then with a pen dipt into it, draw what letters you wil upon paper, or parchment, and when they are through dry, black all the paper over with ink ; and when it is dry, you may with a knife scrape al the letters off that you write with the yolk of the Egg, and they will shew fayr and white.

How to soder upon Silver, Brasse, or Iron.

There are two kindes of Soder, to weet, hard Soder, and soft Soder. The soft Soder runneth sooner than the hard ; wherefore if a thing be to be sodered in two places, which cannot at one time wel bee performed, then the first must be sodered with hard Soder, and the second with soft ; for if the first be done with soft, it will unsoder again before the other be sodered. Note, that if you would not have your Soder to run over any one part of the piece to be sodered, you must rub over that part with chalk that you would not have it run upon.

Note likewise, that your Soder must be beaten thin, and then layd over the place to be sodered, which must be first fitted together,,

gether, and bound with wyer as occasion shal require. Then take Burras, pouder it, and temper it with water like pap, and lay it upon the Soder, and let it dry upon it by the fier : afterwards cover it with quik coales, and blow them up, and you shall see your Soder run immediatly : then presently take it out of the fier, and it is done.

Hard Soder is thus made.

Take a quarter of an ounce of silver, and a three penny weight of copper, melt them together, and it is done.

Soft Soder is thus made.

Take a quarter of an ounce of silver, and a three penny weight of brasse, melt them together, and it is done.

How to gild Silver, or Brasse, with gold-water.

First take about two ounces of quicksilver, put it into a little melting pot, and set it over the fier, and when it beginneth to smoak, put into it an angel of fine gold ; then take it off presently, for the gold wil presently be dissolved in the quicksilver, which if it be too thin, you may thorow a peece of fustian strain a part of the quicksilver from it. Note likewise, that your silver or brasse, before you go about to gild it, must bee boyled in Argall, and Beere, or water, and afterwards scratcht with a wyer brush ; then rub the gold and the quicksilver upon it, and it wil cleave unto it, then put your silver or brasse upon quick coales untill it begin to smoak : then take it from the fier, and scratch it with your wyer brush : do this so often untill you have rubd the quicksilver as clean off as you can, then shall you perceive the gold to appeare of a faint yellow colour, which you may make to appeare fayr with Sal-armoniack, Bole-armoniack, and Verdigrease ground together, and tempered with water.

How to take the smoak of Tobacco thorow a glasse of wate.

First fil a pint glasse with a wide mouth, almost ful of fayr water ; fil also a pipe of Tobacco, and put the pipe upright into the glasse of water, so that the end of the pipe may almost touch the bottom of the glasse ; then take another crooked pipe, and put it into the glasse, but let the end thereof not touch the water ; wax then the mouth of the glasse, that no ayer may come in nor out, but at the pipes : then put fier

fier unto the Tobacco, and suck with your mouth at the end of the crooked pipe, and you shal see the smoak of the Tobacco penetrate the water, and break out of a bubble, and so come into your mouth.

How to colour wood of a fine brown colour.

First take a brush made of hogs bristles, and dip it into common aqua fortis, and therewith wet the wood all over, then dry it gently before the fier, and when the wood begins to change colour, rub it over with Linseed oyl, and then dry it in the Sunn, and it wil be of a dainty fine brown colour, as brown as a berry.

To colour Ivory or any other bones, of an excellent green colour.

Take aqua fortis, wherein dissolve as much Copper as the said water is able, then let the bones that you would have coloured, ly in the same all night, and they will be like a Smaragdin-colour: *Mizaldus.*

How to make Birds drunk, so that you may take them with your hands.

Take such meat as they love, as Wheat, Barley, and lay the same to steep in the Lees of Wine, or else in the juyce of Hemlock, and sprinkle the same in places where Birds use to haunt.

A way to catch Crows.

Take the Liver of a Beast, and cut it in divers pieces, put then into each piece, some of the pouder of *Nux vomica*, and lay these pieces of Liver in places where Crows and Ravens haunt. Anon after they have eaten them, you may take them with your hands, for they cannot fly away.

How to take Crows or Pigeons.

Take white Peasen, and steep them eight or nine days in the Gall of an Ox; then cast the same where they use to haunt.

You may make Partridges, Ducks, and other Birds drunk, so that you may take them with your hand, if you set black Wine for them to drink, in those places whereunto they resort.

Another.

Take Tormentil, and boyl it in good Wine; put into it Barley or other grain: sprinkle it in those places you have appointed to take Birds in, and the Birds will eat the pieces amongst the

Grain, which will make them so drunk, that they cannot fly away. This should be done in Winter, and when it is a deep snow.

Another way to take Birds..

Make a Paste of Barley-meal, Onion-blades, and Henbane-seeds; set the same upon several little Boards, or pieces of Tyles, or such like, for the Birds to eat of it.

How to make Brass white for ever.

Take Egg-shels, and burn them in a melting-pot, then pouder them, and temper them with the whites of Eggs, let it stand so three weeks, heat your Brass red-hot, and put this upon it.

A device to scour Brass..

Take common *Aqua fortis*, and fair water; of each a like quantity, shake them together, dip a woollen-rag in this water, and therewith rub your rusty Brass, and it will fetch off the rust immediatly; then presently rub it off with an oyly-cloth: lastly, with a dry woollen-cloth dipt in the Pouder *Lapis Calaminaris*, (which you may have at the Apothecaries) rub it over hard, and it will be as clear and bright as it was when it came new out of the shop.

How to make the Apparicions of Towers and Castles to appear in a Glass of water.

Take a Urinal, and fill it almost full with fair water, and take a little Saffron and ty it up in a fine Linnen-cloth, and steep it in the said water, and let it remain untill it have turned the colour of the water, then take the white of an Egg and break or squeeze it between your fingers seven or eight times together, then put it into the water, and shake it together, and you shall see such Apparicions as I have said. *Cardanus* and *Falopius..*

How to make the Philosophers Tree.

Take two ounces of *Aqua fortis*, and put into it half an ounce of fine Silver refined, then take an ounce of *Aqua fortis*, and two drams of *Quicksilver*; mix them together; mix both these mistures or dissolutions together; then put it into a Glass, with half a pint of water, and stop it up close with Brimston, and you shall day after day see the likeness of a Tree to grow by little and little very pleasant to behold. *How..*

How to keep Wine fresh all the year, though it be carried from place to place, and exposed to the heat of the Sun all day.

Put your Wine in a glass-bottle, and put the bottle in a box of Wood or Leather, and about the glass-bottle put Saltpeter, and it will preserve and keep it very fresh. If you put some little quantity of Saltpeter in the Summer-time when the weather is very hot, the Saltpeter will make the Wine so extreme cold, that it will even make the teeth of him chatter that holdeth it in his mouth.

How to make Marble.

Take six ounces of quick Lime, put it into a Pot, and pour upon it one pint of good Wine; let it stand five or six days, stirring it once or twice a day; then pour off the clear, and therewith temper Flint-stones calcined, and made into fine pouder, then colour it, and make of it what you please, and let them dry.

How to whiten Copper.

Take a thin Plate of Copper, heat it red-hot divers times, and extinguish it in common Oyl of Tartar, and it will be white.

To make Saltpeter.

Take quick Lime, and pour warm water upon it, and let it stand six days, stirring it once or twice a day; take the clear of this, and set it in the Sun untill it be wasted, and the Saltpeter will remain in the bottom.

How to make Corall.

Take of red Lead ground one ounce, Vermilion finely ground half an ounce, unquenched Lime and pouder of calcined Flints of each six ounces, these pouders must be tempered with a *Lixivium* that is made with quick Lime and Wine: add unto the whole a little Salt; then make thereof what you list; then boyl them in Linseed-oyl.

How to make Pearls.

Take some Chalk, and put it into the fier; there let it ly untill it break: temper it then with the whites of Eggs. Then make of it divers fashions of Pearls, both great and small; wet them being dried, and cover them with leaf-gold, and they are done.

A precious Oyl for a sudden Ach caused through cold.

Take three pound of May-butter unsalted, of Bay-leaves three hand-fuls, of Chamomil, Featherfew, Wormwood, and Rue, of each two handfuls; shred all these finely into a Pipkin closely stopped; let them boyl gently the space of an hour, then put into them eighteen spoon-fuls of Sallet-oyl, and let them boyl an hour more; then add two and twenty spoon-fuls of *Aqua vita*, and then let them infuse a quarter of an hour more, then strain it, and it is done: when you use it, warm it, and anoint the grieved place therewith. Dayly experience doth testifie the excellency of this Medicine.

Against setling of cold about the Head and Stomack.

Take of the best English Saffron the waight of one shilling six pence, of Licoris half an ounce, Angelica-roots half an ounce, Aniseeds one ounce, Elecampane-roots a quarter of an ounce, one Nutmeg sliced, two branches of Rosemary stripped; steep them all in a pint and a half of the strongest *Aqua vita*, in a Glass stopped very close, nine days together. Then let the sick take two spoon-fuls in the morning fasting, and as much at bed-time.

An approved and excellent Plaister for the Sciatica, for Ach in the Reins of the back, or in any other part whatsoever..

Take one pound of black Sope, and four ounces of Frankincense, and a pint of white-wine-vineger; boyl all together upon a gentle fier untill it be thick, spread it then upon a Leather, and apply it unto the grieved place. If the Ach be very great and fervent, then add unto it a little *Aqua vita*, and it will be much better.

An excellent Ointment for the Shingles, Morphew, Tetteres, and Ring-worms.

Take a quarter of a pound of Sope; and mingle with it two drams of the pouder of black Ellebor, Litharge of Silver in fine pouder two ounces, Verdigrease half an ounce, and a quarter of an ounce of Glass in pouder, and as much Quick-silver, make them all into an Oyntment by stirring them well together; wherewith anoynt the grieved parts. This is approved and true.

*An excellent Balm, or Water for grievous sore Eyes,
which cometh either of outward accident, or of
any inward cause.*

Take two spoon-fuls of the juyce of Fennel, and one spoonfull and a half of the juyce of Celandine, and twice as much Honey as them both; then boyl them a little upon a chafing-dish of coals, and scum away the dregs which will ascend, but first let it cool somwhat, and then let it run through a fayr clean cloth; then put it into a Viol of glas, and stop it close. Put a little quantity of this into the Eye. This Medicine is approved, and more precious than Gold.

A speedy Way to asswage the pain of any Scald or Burn, though never so great, and to take the Fier out of it.

Take old Lawn-rags, dip them in Runnet, for want of it dip them in Verjuyce, and apply them cold unto the grieved place, shifting them for half an hour together, as oft as they dry. This I have known to give ease in an instant, and quickly to take out the Fier.

An approved Oyl for to heal any Burn or Scald.

Take of Housleek one hand-full, and of Brooklime as much, boyl them in a quart of Cream untill it turn unto an Oyl; boyl it very gently: with this Oyl a little warmed, anoynt the grieved place twice a day, and it will soon make it well. Approved.

*An Oyntment very excellent, and often proved,
for the same.*

Tak a good quantity of Moss scraped from off a stone-wall, fry it in a frying-pan with a Call of Mutton-suet a good while, then strain it, and it is done. Dress the grieved part therewith once or twice a day, as you shall see fitting.

Another Oyntment for a Burn.

Take one part of Sallet-oyl, and two parts of the whites of Eggs, beat them together exceeding well, untill they come to be a white Oyntment, wherein dip the feather of a black Hen, and anoynt the grieved place divers times every day, untill such time as the scales fall off, using in the mean while neither clothes nor

any outward binding, for these will stick, and so together draw off the skin. This, saith *Minschet* the Authour, though it seem to be a thing of no estimation, yet was there never found any more effectual for a Burn than it is. Since I wrote this I received a Letter from an especial friend in the Countrey that hath often times made use of it, affirming the excellency and undoubtedness of it, saying also, that this very Medicine is of much value.

An excellent Oyntment for a green wound.

Take four hand-fuls of Clowns, and All-heal, bruise it, and put it into a Pan, and put to it four ounces of Barrows-grease, Sallet-oyl half a pound, Bees-wax a quarter of a pound; boyl them all untill the juyce be wasted; then strain it, and set it over the fier again, and put unto it two ounces of Turpentine, then boyl it a little while more, and it is done. Put hereof a little in a Saucer, and set it on the fier, dip a Tent in it, and lay it on the wound, but first lay another Plaister about the wound, made of *Diapalma*, mollified a little with Oyl of Roses. This cureth very speedily all green wounds, as saith Mr Gerard.

A Balsam of wonderfull efficacy.

Take Burgundy-pitch, Brimston, and white Frankincense, of each one ounce; make them into an Oyntment with the whites of Eggs: first draw the lips of the wound, or cut, as close as you can, then lay on some of this spread upon a cloth, and swathe it over afterwards.

An excellent healing Water, which will dry up any old Sore, or heal any green wound.

Take a quarter of a pound of Bolearmoniack, pouder it by it self, then take an ounce of Camphire, pouder it also by it self; also take four ounces of white Coppras in pouder; mix the Coppras and Camphire together, and put them into a melting-pot, and set them on the fier, untill they turn unto water; afterwards stir it untill it come to be as hard as a stone, then pouder it again, and mix it with the Bolearmoniack: keep this pouder close in a bladder, when you would use it, take one pint and a half of fair water, set it on the fier, and when it is even ready to boyl, put into it three spoon-fuls of the pouder,

der, then take it off from the fier, and put it into a Glass, and let it stand untill it be clear at the top, then take off the clearest, and wash the Sore very warm therewith, and dip a Cloth four-fold in the same Water, and binde it fast about the Sore with a Rouler, and keep it warm: dress it thus twice a day.

A Water for a Fistula.

Take a pint of white-wine, one ounce of juyce of Sage, three penny weight of Borace in pouder, Camphire in pouder the weight of four pence; boyl them all a pretty while on a gentle fier, and it is done: wash the Fistula with this Water, for it is certainly good, and approved to be true.

A Water for the Tooth-ach.

Take Ground-Ivy, Salt, and Spearmint, of each an handfull; beat them very well together, then boyl them in a pint of Vineger, strain it, and put a spoon-full of it into that side that aketh, and hold down your Cheek.

Another Water approved for the same.

Take red Rose-leaves half a hand-full, Pomegranate-flowers as many, two Gauls sliced thin; boyl them all in three quarters of a pint of red Wine, and half a pint of fayr water untill the third part be wasted; then strain it, and hold a little of it in your mouth a good while, then spit it out, and take more. Also if there be any swelling on your Cheek, apply the strainings between two Clothes as hot as may be suffered. This I have known to do good unto divers in this Citie, when as they have been extremely pained.

To make a Water for the Eys.

Take *Lapis Calaminaris*, and burn it in the fier nine times, and quench it in white Wine, and beat it into pouder, and when you use it, put it into Rose-water, and drop the Water into the Eys.

For Deafness.

Take a good quantity of Camomil, and two hand-fuls of green Wormwood, and seethe them in a pot of running-water till they be very well sodden, and put a funnel over it, and

and let the steam go up into the eare, and then go to bed warm, and stop your eare with a little black wooll : and a grain of Civet : doe this morning and evening, and with Gods assistance you shall finde ease.

An excellent Electuary for the Cough, Cold, or against Flegm.

Take of Germander, Hysop, Horehound, white Maidenhayr, Agrimony, Bettony, Liverwort, Lungwort, and Harts-tongue, of each one handfull : put these to nine pintes of water, and let them boyl to three pints ; then let it coole and strain it. To this juyce put of clarified Honey halfe a pound, fine pouder of Liquorice five ounces, fine pouder of Enulacampana root three ounces, boyl them to the thicknesse of an Electuary. Take of this at any time, but speciall in the morning fasting, as also at night when you goe to bed, or two houres after supper, the quantity of a Walnut or Nutmeg.

*A very excellent Salve to heal, well approved, for
any old sore ; or new wound.*

Take of Wax, Rosin, Sheepe's suet, Turpentine, of each a like quantity, Sallet oyl also as much : mix them al together, and take the juce of Smallach, of Planten, of Orpin, of Bugloss, of Comfrey, of each a like quantity : let them boyl untill the juce of the Hearbes be consumed ; and in the seething put a quantity of Rose-water, and it will be a very good Salve.

A sovereign Water to heale a green wound : and to stench blood.

Take a pottle of runing water, and put thereto foure ounces of Allum, and one ounce of Copras, and let them seeth to a quart, and then strain it, and keep it in a glasse, and wash the wound, and wet a cloth, and lay to the Sore, and with Gods help it will soon be healed.

Against bleeding at the Nose

Take the root of a Red Nettle, and hold it between the molary teeth of the same side : this is an excellent remedy : Also mosse that groweth at the foot of an Ash, is very good to be put up into the Nose. Likewise the pouder of Toads. Also if you tye a live Toad in a Net, and hang it about the Pacients

Patients neck, he will be in a sudden fear, and so the blood will leave his former current, and have recourse unto the heart. Or else a dried Toad held in ones hand, or hanged about ones neck, though *in scio patiente*, from the natural apprehension of a Venemous object, which whiles nature and the spirits seeking to avoyd, they run into the center of the body from the circumference.

For the biting of a mad Dogge.

Take brine, and bathe the wound : then burn Claret wine, and put in a little Mithridate, and so let the patient drink it ; Then take two live Pigeons, cut them thorow the middle, and lay them hot to his hand if hee be bitten in the armes. If in his legges, to the soles of his feet.

An Oyl for any Ach.

Take a pound of unwashed Butter, and a handfull of red Mints, and a handfull of Camomill, a handfull of Reu, two ounces of oyl of Exeter : stamp the hearbes to a juyce, and boyle them with the Butter ; strain them in a cloth, and rub them out very well : this so done, take the Oyl of Exeter, and put to them, and stir them well together, and put them into a galley-pot, and where the ach is anoint the place against the fier, and lay a brown paper on it, and wrap a cloth about the place, and keep it warm : proved to be excellent.

To stench the bleeding of a cut.

Take a peece of a Felt-hat, and burn it to a coal ; beat it to pouder, and put it in the cut, and it will stench the bleeding presently. Or else apply linnen rags that in the spring of the year have beene often washed in the sperm of Frogs, and afterward dried in the Sunne.

For an Agu, to be layd to the wrists.

Take a handfull of Soot, a spoonfull of Bay-salt, halfe a spoonfull of pepper ; bruise them together, and temper them with two yelks of egges ; spread it on a cloth, and lay it to the wrists.

Almond Milk for the cough of the Lungs.

Take foure spoonfuls of French Barley well washed, and
E.e boy

boyl it in three wine pints of fayr water, unto a pinte and a halfe ; then take it from the fier, and let it cool, and sette ; then take the cleer liquor, and strain therewith a quarter of a pound of sweet Almonds blanched, and beaten ; then set it on the fier, and let it boyl a while til it begin to grow thick ; then beat two yelks of egges, and put them to it ; stirre them well together, and put to it as much fine Suger as will sweeten it, and a spoonfull of Damask Rose-waters, and so let it boyl a while longer, till it be as thick as good cream ; eat of it warm twice or thrice a day, but at breakfast especially.

For a scald Head.

Take a pinte of running water, and as much Mercury as a good Walunt, three or fou'e branches of Rosemary ; boyl these all together till a third part bee boyled away, or thereabout, and every morning and evening wash the infected place with some of this water cold, and a quarter of an hourre after or lesse anoint the place with Lamp oyl, and every morning after the first dressing try to pul up some of the hayr as easily as you can : have care where you set this water, for it is poyon. If you shave the head, and apply a plaister called *Emplastrum Cephalicum cum Euphorbio*, it is also excellent if you adde unto it in the making, a quantity of green Copras.

For to heale a Red Face that hath many pimples. Proved.

Take foure ounces of Barroues-grease, and as much oyl of Bayes, halfe an ounce of quicksilver killed with fasting spettle ; then take two spoonfuls of wilde Tansy water, or Honey-suckle-watet, and let all be ground in a Morter three houres at the least, untill you see nothing of the quicksilver, and so keep it close in a glasse ; the older, the better ; and when you go to bed anoint the Face, and look you keep it from your eyes.

To wash the Face if it be given to heat.

Take Snai.es, beat them shels and bodies together : steep them a night in new milk ; then still them with the flowers of white Lillies.

To make odiferous Damask water.

Take new Ale with the graines in it, three gallons, Chamomil

momill three handfuls, Balm, Rose leaves, of each four handfuls ; Lavender and Southernwood, of each two handfuls ; Marjerom six handfuls ; beat them all into grosse pouder, and then infuse them in the Ale ten or twelve dayes, stirring it once or twice a day ; then put it into a Rosewater Still, and strew upon it this following pouder, and distill it with a gentle fier.

The Pouder.

Take Cloves, Cipres roots, *Calamus aromaticus*, of each one ounce ; Mace an ounce and a halfe, Orris two ounces ; Storax, Benjamin, Labdanum, of each halfe an ounce ; make them into a pouder.

A damask water that may be made at any time of the year.

Take Lavender flowers, two ounces, Cloves six ounces ; Orris one pound, green Bay leaves two ounces, *Calamus aromaticus* four ounces, Broom bark two ounces, Storax four ounces, Cypres roots halfe a pound, Margerom two handfuls ; make them altogether into a grosse pouder, and infuse it in five gallons of fayr water three or four dayes, in which time you must stirre it three or four times a day and cover it close : then distill it with a gentle fier, while it is stilling, open it now and then, and stir it that it may not stick to the bottom.

For a Cold, or for chapt hands.

Bathe your feet oftentimes in Beer wherein store of Salt and Tartar hath been boyled, and dry it in by the fier : this is good for a Cold.

Bathe your hands also in like manner, if they be chapt, for it is an excellent and most approved Medicine.

Against the Murrain of Swine.

With an Aul bore a hole in the top of one of their Ears, and thrust therein a little piece of the root of black Elebor ; it will cause their Ears to swell, and store of water will issue out thereat, and it will certainly free them from the Murrain : approved.

A Secret for Travellers.

It is a slight, but, in my opinion, an excellent thing, and a thing that I have much set by ; let such as use to travel, especi-

ally in the Summer-time, have about them a piece of Roch-Allum, which they may now and then hold for a small time in their mouths, for when they are hot it will both cool them, and mightily refresh them, and will quench their thirst more than any Beer can: I confess, I have a better liking unto a stone that is made of Saltpeter, and the eighth part of Oriental and transparent Sulphur melted together, and cast into bullet-moulds; it is a stone that divers Mountebanks much esteem of, and it is called by them, A *Celestial or Miraculous* stone; and by addition of certain colours, they make some red, some bleu, and some of a straw-colour; and they attribute divers virtues unto it, as for curing the Pin and Web in the Ey, for Inflammation of the Mouth and Gums, and for curing of aking Teeth; it is indeed nothing but the stone called of the Apothecaries *Lapis Prunella*, and which they ordinarily sell. I have made use of Allum when I could not come at this, and have found it for the aforesaid use not much differing.

To make Usquebah...

Take a Gallon of the smallest *Aqua vita* you can make, put it into a close vessel of stone; put thereto a quart of Canary-Sack, two pound of Raisins of the Sun stoned, but not washed, two ounces of Dates stoned, and the white skins of them pulled out, two ounces of Cinamon grosly bruised, four good Nutmegs bruised, four good Licoris-sticks sliced and bruised, ty up all your Spices in a fine Linnen-cloth, and put them into your *Aqua vita*, and ty up your Pot very close, and let this infuse a week, stirring it three times a day, then let it run through a Jelley-bag close covered; keep it in glass-bottles.

To make Almond butter.

Take two pound of Almonds and blanch them, and let them ly all night in cold water; then grinde them in a Mortar very small, and put in a blade of Mace or two; then strain it through a strong Cloth as near as you can, that the milk be not too thin, and let it seethe a pretty while, then put in a little Rose water, and a little Salt, when you take it off the fier, and stir it still; then take a big Cloth very clean, and let two hold it, then you must take the Milk and cast it round about the sides of the Cloth, that the Whey may come from it, then with a Saucer put it.

it down from the sides ; then knit the Cloth, and hang it up until it have left dropping ; then take it forth, and season it with fine Sugar and Rose-water.

*To make Jelley for one that is in a Consumption, or troubled
with a Loosness.*

Take the feet of a Calf, and when the hayr is clean scalded off, slit them in the middle, and cut away all the black veins, and the fat, and wash them very clean, and so put them in Bucket of fair water, and let them ly four and twenty hours, and in that time the oftner you shift them in fair water, it will be the better ; then set them on the fier in two gallons of water, or somewhat less, and let them boyl very softly, continually taking off the scum and fat which riseth ; and when the Liquour is more than half-boyled away, put into it a pint and a half of white Wine, and as it boyleth there will come a foul scum upon it, take it off still clean, and when the Jelley is boyled enough, you may know, for your fingers will stick to the spoon ; then take it from the fier, and with a Cullender take out all the bones and flesh, and when the Jelley is almost cold, beat the whites of six Eggs, and put into it, and set it on the fier again, and so let it boil till it be clear ; then strain it through a clean Cloth into a Bafon, and so let it stand all night long ; the next morning put it into a Skillet, and put to it a pound of Sugar, half an ounce of Cinamon broken in pieces, one ounce of Nutmegs, an ounce of Ginger bruised, and a good quantity of large Mace ; boyl all these together till it taste of the Spices as much as you desire ; and when it is almost cold, take the whites of six Eggs, and beat them, and put into it, and set it on the fier, and when it riseth weild it in half a pint of white Wine, then strain it through a Jelly-bag.

To stay the Flux.

Take Date-stones, and beat them to fine pouder, and take the quantity of ore of them, and drink it with Posset-drink, or Beer ; use these two or three mornings together, and after as often as you finde occasion ; this is very good.

In the moneth of May gather of the reddest Oak-leaves you can get, and stille them, and when need requireth make Pap thereof, mingled with Milk, fine Flour, Sugar, and Cinamon, as oft as your Stomack serveth to eat it..

Hom.

EXTRAVAGANTS.

How to make good writing Ink.

Take two hand-fulls of Gauls, cut each Gaul into three or four pieces, pour into them a pint of Beer or Wine, then let it stand eight hours; strain it from the Gauls, and put Vitreol therein, and to the Vitreol a third part of Gum; set it on the fier to warm, but let it not seethe, and it will be good Ink: and of these Gauls you may make Ink four or five times more.

How to make Red Printing Ink.

Take a spoon-full of Vermilion, the quantity of a Hazel-nut of clean Turpentine, with a spoonfull and a half of Linseed-oyl; grinde them altogether upon a Painters stone, and it is done.

How to make blw Printing Ink.

Take Bice or Smalt, and grinde them with Turpentine and Oyl, as you did the former.

How to make yellow Printing Ink.

Take refined Orpiment, and use it as you did the former.

How to make green Printing Ink.

Take Verdigrease or Spanish-green very clean, and without stalks, and grinde it as you did the former.

How to make black Printing Ink.

There is a black Earth which those that print Maps use of, this being ground as the former, with Turpentine and Linseed-oyl, you may make black Ink.

To make green Ink.

Take green Bice and grinde it with Gum-water, and if you will have it a sadder green, put a little Saffron to the grinding.

To make White Ink.

Take fine Flour, and grinde it with a little Chalk, and Allum, and then put it in a Viol.

For an Ague.

Take a hand-full of Harts-tongue that groweth in the field, and a hand-full of Bay-salt, and beat them both together in a Morter, and lay this to both the wrists.

A good

A good water against the Plague, or to be given after a Surfeit.

Take red Sage, Celendin, Rosemary, Herbgrace, Wormwood, Mugwort, Pimpernell, Dragons, Scabious, Egrimony, *Rosa Solis* and Balm, of each a handfull, or like quanty by waight; wash and shake them in a cloth, then shred and put them into a gallon of white wine, with a quarter of an ounce of Gentian roots, and as much of Angelico roots; let it stand two dayes and two nights close covered, and then distill it at your pleasure, and stop the glasse very close in which you keep the same.

To avoyd urin that is stopped with the stone..

Take as much black Sope as a walnut, temper it with eight or ten leaves of English Saffron, spread it upon a round leather as big as the palm of your hand, and cover the navell of your belly therewithall, and it shall cause you to make water. And I have been informed by a kinde of Leach that liveth in the Country, that he by applying a plaster of galbanum spread upon a peece of leather round about the *preputium*, cured one that could not avoyd his urin by reason of a stone, which within a few houres the plaster brought away, so that the party recovered, and became perfectly well; who dying two or three yeeres after, rewarded this his Surgeon with a liberall reward.

For the Stone and strangury.

Take the filmes that are within the mawes of Geese, and let them bee purely dryed, and then make pouder thereof, and drink it with stale Ale, and it will help him with Gods grace. Proved.

A good Medicine to avoyd the Stone and gravell.

In the morning fasting let the party swallow three or foure peeces of fresh Butter about the bignesse of Nutmegs, and drink immediatly after a glasse full of white Wine, and so fast until dinner. It is a mean Medicin, but not to be contemned, for there are those that I know can affirm the goodnessse and effects thereof.

For scald-heads.

Take green Copperas, and mingle it with cream til it bee turned yellow, and let it stand three or foure dayes: then take Primrose roots, leaves and all, with May-butter, and beat

beat the roots and leaves in the Butter, and boyl them together with a little Beer and Butter, and let it touch to Salt.

To cure an old ulcer.

Take a quart of the strongest Ale that is to bee gotten, or breued, halfe a pint of raw Honey, two ounces of Roch-allum beaten, halfe a pinte of Sallet oyl, and the quantity of a Tennis-ball of common washing Sope, one ounce of Stone-pitch beaten, one ounce of Rozin beaten, two ounces of yellow wax : boyl al these together, and strain them thorow a thin Linnen cloth ; and this wil cure any old Ulcer.

A water to cleanse and mundifie old rotten sores and ulcers,

Take a wine-pinte of water of Planten, as much white wine ; put therein two ounces of Roch-allum, a dram of Verdigrease, a dram of Mercury sublimed : boyl al these together, and keep them in a thick glasse being stopped with wax very close, that the strength go not out ; this wil cleanse and mundifie old sores : It wil also heale a Fistula if you use a siringe, so that the water may be sent to the bottom of the sore.

The Medicine of Medicines proved for the Stone.

Take a quantity of Eg-shels, wash them clean ; those are the best whereout chickens are come ; dry them very dry in an Oven, or between two Tile stones ; then make pouder thereof, searce it, and mingle it with Sugar, or pouder of Licoras to give it a taste, and let him use it as often as hee needeth, morning and evening, either with Rhenish wine, white wine, or stale Ale, a spoonful of the pouder at a time, and use to make water in a clean bason, and so you shall see the deliverance thereof.

For burning or scalding.

To take out the fier, beat Onyons very small, and binde them to the place. To heale it, take halfe a pound of sheeps suet, as much sheeps dung, a quarter of a pound of the inner rinde of an Eldern-tree, and a little Housleek : fry them together, and strain it, and use it as a plaister, or make a sea-cloth of it, and apply it to the grieved part.

For Burstnesse of old, or young.

Take nine red Snailes, lay them between two tyles of clay, so

so that they creep not nor slide a way, and bake them in the hot embers, or in an oven, til they may be powdered, then take the pouder of one of the Snailes, and put it in white wine, and let the patient drink it in the morning at his rising, and fast two houres after, and drink these nine Snailes in eighteene daies, that is, every other day one. And if the sicknesse be so old that it will not heal in eighteen daies, begin again, and drink other nine Snailes, and he shall bee whole : this considered, that he weare a Trusse in the meantime, according to the manner of the rupture.

A Salve for all sores.

Take a pound of sheeps Tallow, and a pound of Turpentine, and a pound of Virgin-wax, a pinte of Sallet oyl, a quarter of a pound of Rozin : take also Bugle, Smallach, and Plantain halfe the quantity of the other, or so much as will make a pinte just : boyl al these together upon a soft fier of coales, always stirring it til a third part be consumed ; then take it from the fier, and strain it thorow a new canvas cloth into an earthen pot.

For dimnesse of sight.

Take the hearb called Eye bright, make it into fine pouder, and take it either with meate or drink, for it hath been approved to be most excellent for al impediments of the sight.

How to make Eye-bright Wine, Ale, or Beere : By the use Whereof, divers that could not read without Spectacles, have miraculously recovered their sights.

You must take two or three handfuls of the herb Eye-bright, and put it in a bag that is made of fine boulter, put also unto it a dram and a halfe of sweet Fenil seeds, and if you please, a Clove or two, or a blade of whole Mace, and into the bag put also a stone to make it sink, then hang it in a gallon of new Wine or wort ; if it bee Wine stop it up close presently, if wort, stop it not untill it hath wrought. After it hath stood a weeke, you may drinke every morning a draught.

A precious water for the sight.

Take Smallage, Fennel, Reu, Vervein, Egrimony, Daf-fadil,

fadil, Pimpernel, and Sage; and stil them with breast-milk, together with five drams of frankincense, and drop of it in your Eyes each night : often proved.

For to stay the Flux.

Take the yolk of an Egge, and beat it, then mix with it one grated Nutmeg, and lay it on an hot Tyle stone to bake, and eat thereof fasting, and before Supper, and after meales, and it will stay it. Often proved to be excellent.

A good Pouder for the Gout.

Take fine Ginger the waight of two groats, and Enula-campane roots dried, the waight of foure groats, of Liquorish the waight of eight groats, of Sugar-candy three ounces ; beat all these into a pouder, scarce them fine, and then mingle them together, and drink thereof morning and evening, and al times of the day. Appoved.

A special Medicin for the Collick.

Take Horehound halfe an handful, of Sage, and Hysop of either as much, twelve leaves of Betony, of Centaury six crops, one Alexander-root, foure penny waight of Enula-campana roots powdered, Spikenard of Spaine one penny-worth ; seethe all these in three quarts of fine wort to a pottle, and draw it through a Linnen cloth, and take three spoonfuls at once morning and evening.

To take away rednesse or burning of the Eyes.

Take the white of an Eg, and beat it very well with a spoonfull or two of red Rose-water, then put thereto the Pap of a rosted Apple , mingle them well together, and spread it upon a little Flax ; so lay it on the Eye, binding it on with a linnen cloth.

A Water for the falling down of rheum in the Eyes.

Take the quantity of a large Hazle-Nut of white Copras, and dissolve it in threes quarters of a Pint of running water; with this water alittle warmd bathe the Eye-lids divers times in a day. Approved.

For the Rheum in the Eyes.

Take the white of an Egg, and so much Bolearmoniack as will chicken

chicken it, and spread it on a round playster of sheeps-leather, and lay it on the temples on that side the Rheum is

The Oyntment for the same

Take *Lapis tutie* and burn it in a fire-shovell of quickcoales, quench it in a Poringe of womans milk, do so half a score times, then grinde it in a clean morter till it be very fine pouder, then mingle it with freshi Barroues grease till it look russet : anoint your Eyes with a littie of it when you go to bed

For Deafnesse.

Take Reu, and rub it between the Palms of your hands untill it be so bruised, that you may make thereof a tent ; then dip it in sweet sallet Oyl, and put in each Eare one, so that you may pull them forth again. This doe for seven or eight dayes, and change the Tent every day.

Take a quarter of a pinte of Angelica water, of *Carduus Benedictus* water, & of white wine, of each a like quantity : mingle them together, dividing the same into two equal parts ; drink it in two severall mornings : then the next night after the taking of the second draught of water, take the fish of an Oyster, and put it into a fayr linnen cloth, and stop the same into the Eare that is thickest of hearing, and lie on that side as long as you can : in the morning pick that Ear as clean as you can, and after that take a draught of the best Ale you can get, with a Toast of household bread toasted very dry, & a reasonable quantity of Nutmeg ; use the same every morning for five or six dayes, fasting after the taking hereof two houres, every time you take it

For the Cough of the Lungs

Take two handfuls of Rosemary and strip it off the stalk, one of Hysop, and seethe them in a Pottle of running water, till it come to a quart, and then put a quarter of a pound of fine Sugar, and let it seeth a little, and scum it, drink it morning and evening..

A present Remedy for all manner of Aches, and Bruises in the Bones.

Take a good quantity of Walwort, and a certain quantity of Balm, and Smallach, and stamp them, and take a pound of May Butter, and temper them very well together, then make them into round Bals, and let them lie for the space of eight dayes after, and then stamp them again as you did before : then take it

and fry it, and strain it, and put it into an earthen pot: This will help the Bruise, be it never so black.

For Bleeding.

Take a black Toad in May, dry it between two Tyle-stones, and hang it in a Sarcenet about the parties neck.

To procure sleep.

Take Betony, Rose-leaves, Vineger, Nutmeg, and the crums of Rey-bread: put this in a Cloth warm to the poll of the Head.

For the Cough.

Two hand-fuls of last Savory, steep it five days in white-wine-vineger, put into the Vineger half an ounce of Pepper, at the five days end drain out the Vineger, and as soon as the Bread is drawn, set them in a Peuter-dish into the Oven, and stop it up, and let them stand all night. In the morning take them out of the Oven and pouder them. Take of this pouder and drink it with Sack, so much of it as will ly on a threepence.

A Gargil for the Uvula.

Take a pint of good strong Ale, and as much Sack, and a good quantity of long Pepper, and bruise it grossly, and boyl it from a quart to a pint, and let the parties gargle their mouths and throats as warm as they may suffer it.

If the pallat of the mouth be down, it will fetch it up.

For Deafness very excellent.

Take the hoofs of a Neats-feet after they bee sodden, and hold them in a Cloth so warm as may be to your ear, divers times together one after another; they will last to be warmed in the same they were sodden in, some three or four days without sowing.

How to destroy Vermin or Lice in ones Head or Clothes.

There is a Berry which you may bey at the Apothecaries, it is called *Coccus Indic*; make it into fine pouder, and strew it in the hayr of your Head, if the Lice be onely there, and binde the Head close up, and it will for certain slay them all before the next morning: if they be about the Clothes and the Body also, then mix some of the pouder with some fresh Butter or Hogs-grease,

grease, and anoynt the seams of the parties Garments, especially about the neck, waste, and gatherings of the Garments, also boyl some of the Berries in a pint of fayr water, and the waight of six pence of Mercury sublimate, then strain it, and bathe the party with a Cloth dipt in this water, made bloud-warm, but especially about his Joyns, and it will quit him, though he be never so full: approved.

How to make excellent Trosses or Cakes to purifie the Ayer in the time of the Plague.

Take one ounce of Myrrhe powdered, also an ounce of the Hour of Brimston, as much Balsam of Peru as will make them into a stiff Paste, then make it into little Cakes; you may in time of Pestilence every or every other day put one or two of these upon a Chafingdish of quick coals, and betake your self into some other place, untill the smoak ceas. *Minshet.*

To provoke Sweat, and to cleanse and clarifie the Bloud.

Give the party twenty Grains of the flour of Brimston mingled with a little white-wine-vineger, or Oximele-simple; it will provoke to sweat, and cleanse the bloud mightily. *Idem.*

Brimston mingled with Pitch, and so wrought upon Wood, will not suffer it to be taken with Worms, nor to putrifie with Winde or Weather. *Idem.*

The smoke of Brimston conveyed with a convenient Instrument into a Vessel of corrupt Salt, and stinking water, it will in a short time purifie the same, by sending the dregs into the bottom. *Idem.*

For an old Sore: approved.

Take a pound of Oyl of Olives, two ounces of Honey, one ounce of Turpentine, two ounces of white Wax, Frankincense, and Olibanum, half an ounce of each, black Pitch half a pound; melt them altogether, and reserve it for your use.

How to make white Jelley.

Take two pound of Almonds, and make Cream of them, then boyl three ounces of Isinglass in a quart of fair water, to a pint, then mix it with your Cream, adding to them one pound and a quarter of refined Sugar, and a quarter of a pint of Rose-water; boyl them all together a little while, and then strain it, and it is done.

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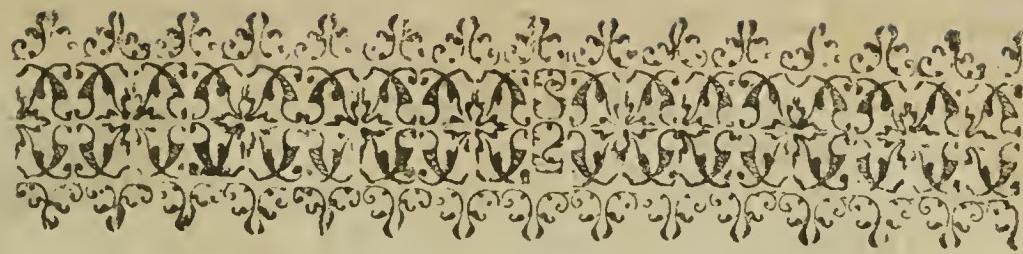
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